Division of Agricultural Sciences
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THE USE OF MINIMUM GRAPE SUGAR CONTENT REQUIREMENTS FOR CONTROL OF TONNAGE OF GRAPES CRUSHED IN THE CENTRAL VALLEY OF CALIFORNIA

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FOREWORD

This study was begun three years ago at the request of the Grape Stabilization Advisory Board. Its completion was deferred because of service by the senior author with the government and with the United Kingdom. The major justification for completing this study is to provide a frame in which suggestions for other methods of quality control may be appraised, to pinpoint the difficulties inherent in any such program, and to make available analyses of the patterns of sugar behavior as a basis for further research into the impact of quality control upon total tonnage crushed and the distribution of the burdens and benefits of such control among areas, wineries, and varieties and over time. The calculations and many of the charts were largely prepared by the junior author. Final preparation is the sole responsibility of the senior author.

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SUMMARY

1. It does not seem feasible to attempt control of the tonnage of grapes crushed for wine in the Central Valley of California through specifying minimum sugar requirements. This conclusion emerges from analysis of more than 20,000 loads of grapes delivered to four wineries over three successive years. It is supported by analyses of the impact of minimum sugar requirements upon major varieties, areas of origin, and wineries. It is impossible accurately to predict in advance of the season the tonnage which would be denied access to the winery as the result of any specified minimum sugar standard. Any such standard would involve crippling disparities of impact among varieties, areas, and wineries. Normal operations of growers and vintners would be seriously impaired. Administration of a plan based on this aspect of minimum quality would be weakened by the necessity for complex provisions for special consideration among producers of different varieties, producers in different areas, and different vintners.

2. No method of volume control other than minimum sugar requirements for grapes is considered here. The merits of volume control or other methods of stabilization are not at issue in this report. Three general questions are posed with respect to the effects of minimum sugar standards: (1) are seasonal averages and variances sufficiently stable among varieties, areas, and seasons to permit predetermination of the effects of a given minimum standard upon total tonnage crushed; (2) are these averages and variances such that different varieties, areas, and vintners would be affected differently by any minimum standard; and (3) are the patterns of average daily change in sugar content such that administration of control would seriously disturb normal harvesting and crushing procedures?

3. With respect to season averages and variances among varieties, areas, vintners, and seasons, differences were statistically significant among: different varieties delivered to one winery in one season; all varieties of grapes combined delivered to one winery over two or more seasons; all varieties of grapes combined delivered in one season to several wineries; individual varieties delivered to one winery in two or more seasons; individual varieties delivered in one season to two or more wineries; and grapes from different areas of origin, in the aggregate or when subclassified by variety, season, or receiving winery. The same conclusions are applicable to the patterns of dispersion of individual load readings about the season average for the various classifications. The ranking of varieties in terms of season average sugar alone is stable. Differences in season averages and variances for all varieties and areas combined were such that elimination based upon specified standards differed widely over the three years, to the extent that no effective prediction of the total effect of any minimum standard appears possible. Differences among varieties, areas, and wineries both within seasons and over two or more seasons were so sharp and unsystematic that impact of elimination would obviously be untenably inequitable. The differences among averages, dispersion patterns, and trends over time, among areas, among varieties, and wineries may be due in part to differences in the relative volumes of the constituent series. However, for the purpose of appraising the proposed sugar control plan, it is sufficient to describe such differences and to determine their impact regardless of the causes of the differences.

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3. With respect to season averages and variances among varieties, areas, wineries, and seasons, differences were statistically significant among different varieties delivered to one winery in one season; all varieties of grapes combined delivered to one winery over two or more seasons; all varieties of grapes combined delivered in one season to several wineries; individual varieties delivered to one winery in two or more seasons; individual varieties delivered in one season to two or more wineries; and grapes from different areas of origin, in the aggregate or when subclassified by variety, season, or receiving winery. The same conclusions are applicable to the patterns of dispersion of individual load readings about the season average for the various classifications. The ranking of varieties in terms of season average sugar alone is stable. Differences in season averages and variances for all varieties and areas combined were such that elimination based upon specified standards differed widely over the three years, to the extent that no effective prediction of the total effect of any minimum standard appears possible. Differences among varieties, areas, and wineries both within seasons and over two or more seasons were so sharp and unsystematic that impact of elimination would obviously be unmanably inequitable. The differences among averages, dispersion patterns, and trends over time, among areas, among varieties, and wineries may be due in part to differences in the relative volumes of the constituent series. However, for the purpose of appraising the proposed sugar control plan, it is sufficient to describe such differences and to determine their impact regardless of the causes of the differences.

4. There were statistically significant trends in sugar content for all varieties combined within each of the three seasons. Trends in 1947 were generally negative; those for 1948 and 1949 generally indicated increases in sugar content as the season progressed. More important, there were significant differences among trends for individual varieties, areas, and wineries which differed sharply from one season to the next. Thus, sugar control would impose opening dates for crushing on some classifications and closing dates for others. In any season these effects would be almost random with respect to impact on particular varieties, areas, or wineries. They would differ widely and randomly from one season to another.

5. The tonnage eliminated in total by any standard was grossly and unsystematically different from one year to another. Within any year it varied among varieties by as much as tenfold. Among areas the tonnage which would have been eliminated by any one of four standards tested would have varied quite as drastically. Thus, the proposed plan offers no basis to predict total tonnage eliminated by any standard; it leads to inequities among areas, varieties, and wineries; it offers little prospect for easy administration; and it would interfere seriously with timing of harvesting and crushing.

4. There were statistically significant trends in sugar content for all varieties combined within each of the three seasons. Trends in 1949 were generally negative; those for 1948 and 1949 generally indicated increases in sugar content as the season progressed. More important, there were significant differences among trends for individual varieties, areas, and wineries which differed sharply from one season to the next. Thus, sugar control would impose opening dates for crushing on some classifications and closing dates for others. In any season these effects would be almost random with respect to impact on particular varieties, areas, or wineries. They would differ widely and randomly from one season to another.

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George L. Mehren[1/] and W. J. Tater[2/]

Major Issues

The main question here is the feasibility of controlling production of wine through specifying minimum sugar content of grapes. Sugar content means Balling or Brix readings. Feasibility is defined in terms of precision of control, administrative burden upon producers, vintners, and regulatory agencies, and equity of benefits and burdens among different varieties, areas, producers, and vintners over different seasons and at different times within each season. With respect to control within any year, there are two specific questions: what tonnage of grapes would be eliminated from wineries by setting various sugar content minima and how would such tonnage be distributed by areas, by times within the season, by varieties of grapes, and by types of producers and vintners? To answer these, two other questions must first be answered: what are the patterns of variation in season average sugar content among varieties, areas, wineries, and seasons and how does sugar content change within the season for different varieties, areas, wineries, and years?

Determinants of Surpluses.--Violent fluctuation in income is probably attributable largely to long-run increase in yield per acre of grapes, drastic annual changes in production, and even wider year-to-year fluctuation in utilization of the crop--all little related to changes in demand. Consequently, control programs for grape products have been formulated in several postwar years. Large tonnages have been diverted through raisin support operations. Sharp changes in price and in value of inventories occur in many perennial crops. Individual growers can, and sometimes must, increase yields per acre despite fears of long-run damage to productivity of vines or quality of grapes. Individual growers cannot shift long-run demands as average annual production increases, control annual variations in industry output, or adjust either acreage or yield to annual changes in demand. Growers deliver grapes to the outlet with highest expected vineyard prices. Vineyard prices of grapes are therefore roughly equalized among all outlets. Thus, control over utilization may occasionally be in the interest of the grape industry to maintain price, income, and inventory values.

Control Over Surpluses.--The price gap between production and the amount salable at desired price levels can be closed in three ways only: (1) by reducing costs; (2) by expanding demand; and (3) by controlling the volume marketed in total or separately in the several uses of grapes. Reduction of production costs for a given output could increase net price to producers without increasing market price. Reduction of marketing or processing costs could result in increased sales without any decrease in prices to growers. Cost reduction is an effective adjustment to long-run shifts in demand or output. It is not a feasible adjustment to

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to control within any year, there are two specific questions: what tonnage of grapes would be eliminated from wineries by setting various sugar content minima and how would such tonnage be distributed by areas, by times within the season, by varieties of grapes, and by types of producers and wineries? To answer these

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Determinants of Outputs.--Violent fluctuation in income is probably attributable largely to long-run increase in yield per acre of grapes, erratic

rules and in value of inventories occur in many perennial crops. Individual ... can damage to productivity of vines or quality of grapes. Individual or ... cannot shift long-run demands as average annual production increases, control changes in demand. Growers deliver grapes to the outlet with highest output ... all outlets. Then, control over individual action may occasionally be in the interest of the grape industry to maintain prices, income, and inventory values.

Substitutes.--The price gap between production and the amount ... able at declined price levels can be closed in three ways only: (1) by reducing ... ; (2) by expanding demand; and (3) by ... for a given output could increase net price to producers without increasing marketings. ... without any decrease in prices to growers. Cost reduction is an effective adjustment to long-run shifts in demand or output. It is not a feasible adjustment to

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sudden and drastic shifts in production, utilization, or demand. Demand is largely determined by the preference patterns and income of consumers and by prices of competing goods, which are all outside the control of the grape industry. Within broad limits the grape industry can produce the products demanded by consumers or persuade consumers to want the products which the industry produces. However, it is not possible quickly to change consumer preferences to counterbalance sudden, unforeseen, and uncontrollable changes in production, utilization, or in other determinants of demand. Nor is it possible quickly to introduce new products. Programs designed to raise demand must therefore be considered as effective adjustments to long-run changes alone.

Limitation of volume produced or marketed appears to be the only device which could effectively control short-run surpluses. The effects and costs of vine removal and restrictions upon cultural practices or new plantings are as yet undetermined. Vines or other capital probably will be withdrawn only when long-run production clearly exceeds long-run demand at profitable prices. Volume marketed can be controlled through: (1) minimum grade and size regulations; (2) volume allotments to growers or handlers; and (3) diversion. Thus far, control over short-run surpluses of grapes has largely involved diversion from commercial channels by one or a few segments of the industry operating separately.

There is easy technical substitutability of many varieties of grapes among wine, table, and raisin uses. There is little substitutability in consumption among the products of the grape industry. The economics of production suggest a single program. The economics of demand create a diversity of interest making an over-all program difficult to achieve.

Volume Control Through Minimum Sugar Content.--This is the setting in which volume control through minimum sugar content must be appraised. The merits of volume control are not directly considered here. In years of high yields, heavy inventories, or low demand, the wine industry may wish to limit the tonnage of grapes crushed in order to prevent acute drops in price. There is no direct reference here to allotment, diversion, or other methods of grade size control. Simultaneous cost reduction or demand promotion programs are considered consistent with short-run control of volume. The single technique appraised here is control over short-run surplus situations through requiring that grapes crushed shall meet some minimum specified sugar content. This appraisal of the sugar minimum proposal will, however, suggest the analysis necessary to appraise the probable effects of any other suggested method for controlling volume through minimum quality standards.

Scope of Sugar Content Pricing

Any purchase of grapes for crushing in which the price per ton is related to sugar content is subject to governmental regulation.3/ Transactions by cooperatives are exempted. Where price is unrelated to sugar content, there is no state supervision of pricing even if minimum maturity and inspection are required by contract. The sugar point is the average percentage of soluble solids by weight

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3/ California Bureau of Fruit and Vegetable Standardization. Standardization Fruit Circular No. 10. Re: Wine Grape Testing (Grapes for By-Products, Chapter 1a). Revised, November 15, 1948. Tests and certification are the responsibility of county agricultural commissioners, but rules are prescribed by the Bureau. Fees are set by county boards of supervisors and paid by buyers. The statute remains largely as first passed in 1939. Before then, county agricultural commissioners had certified grapes for sugar content in Fresno and San Joaquin counties.

in juice sampled from a given load. In the major dessert wine areas, yield of wine per ton of grapes appears to be related to sugar content. Lesser additions of neutral spirits may be required for higher sugar content. Fraud may be decreased. Litigation may be lessened through sugar content contracts. Growers may aim toward high sugar content rather than high tonnage.

Inspection and certification for sugar content are made at time of delivery. Certificates include description of the lots, results of individual tests, and average readings for the lot. Varieties may be tested separately in mixed lots. Individual certification may be made to each owner of a pooled load.4/ Variation in procedures among counties is authorized to meet local conditions. Certification methods are uniform. Sampling and inspection are controlled by county agricultural commissioners under state supervision.

Relatively little tonnage has been certified for sugar in the North Coast, southern California, or Sacramento Valley areas. About 90 per cent of the 1948-49 crushes in Fresno and San Joaquin counties were reported purchased on sugar content contracts, largely by commercial producers of dessert wines. Except for some sorting and grading operations and for separate sale of strippings, there are no major changes in receiving, weighing, unloading, or crushing attributable to the sugar contracts. The sample is thus largely restricted to the dessert wine areas of the Central Valley where facilities for inspection and certification are regularly available.

Specific Questions

In order accurately to control the tonnage of grapes crushed by specifying minimum sugar content, the following minimum information is necessary: the total tonnage of grapes to be produced or the total tonnage which will be delivered to the wineries; the tonnage appropriate to the desired price targets; and the tonnage denied access to the wineries through various alternative sugar content minima. There are no methods at present for accurate prediction of the total grape crop. There is no stable relationship between total grape production and tonnage crushed through which, given estimates of production, the tonnage crushed for wine could accurately be predicted. However, neither of these questions is directly at issue here. In this analysis, only the last of the three general questions is engaged. The general questions studied may be set out as follows: what percentage of total deliveries would have been denied entry to wineries by

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4/ Samples must be: taken from several parts of the lot; adequate in number and weight to represent the load; and sufficient to fill a ten-quart pail. Samples are drawn by hand from box loads and by tube from bulk loads. Readings of degrees Brix from one or more hydrometers, floated in strained juice, are corrected for temperature. Sugar content is approximated by subtracting 2.5 from the readings for white grapes and 3.0 for reds. The corrected degrees Brix is the approximate per cent of sugar by weight. Inspectors are given detailed instructions for methods of making readings and records. Two samples are usually drawn, but more must be taken if differences in individual readings exceed stated limits. The average reading is assigned to the lot, but certificates show all readings and corrections. California Agricultural Code. Division V, Chapter 1b, Section 771-776.

various minimum sugar standards in each of the three years, 1947-1949[5/] and how would this eliminated tonnage be divided up among different varieties, areas of origin, and wineries in each of the three years?

To answer these general questions, several specific questions must first be answered.

First, the season average level of sugar and the intraseasonal daily average changes in sugar level must be measured by varieties, areas of origin, years, and receiving wineries. Second, the statistical significance of the differences in season average sugar levels and in intraseasonal changes in sugar content among the classifications must be appraised. Finally, the dispersion of sugar readings about the season average and the intraseasonal trends must be measured for each of these classifications.

The statistical significance of differences is measured for season average sugar levels among: (1) different varieties delivered to one winery in one season; (2) all grapes delivered to one winery in different seasons; (3) all grapes delivered in one season to different wineries; (4) one variety to one winery in different seasons; (5) one variety in one season delivered to different wineries; (6) one variety delivered to different wineries in different seasons; (7) one variety delivered to one winery in one season but from different areas; and (8) differences in the dispersion of individual observations about the respective season averages are also measured for the various classifications.

The intraseasonal trends and the statistical significance of differences among them are measured through the following: (1) what is the average daily change in sugar content in the various classifications and is the rate of change the same in all parts of the season? Then the statistical significance of differences in trends is measured among the following classifications: (2) different varieties to one winery in one season; (3) all varieties of grapes crushed by one winery in different seasons; (4) all grapes crushed in one year among different wineries; (5) one variety delivered to different wineries in one season; (6) one variety to one winery over three seasons; and (7) different areas of origin for different varieties, wineries, and seasons.

Answers to these questions provide bases to appraise the applicability of sugar content as a means of volume control in the Central Valley of California.

The Data

These data, obtained from official certificates and tally sheets, were classified according to: receiving winery, area of origin, varietal constituency of each load, date of delivery to the winery, and reported sugar content. Records from three wineries were analyzed for 1947-1949 and a fourth for 1947 only. Estimated tonnage represented in calculations was approximately 64,000 for 1947, 91,000 for 1948, and 56,000 for 1949. Most records did not indicate load weight.

5/ This question must be analyzed on the assumption that announcement of the program would not seriously affect harvest or other operations. The question might better be stated as: how much tonnage actually delivered in the three years, 1947-1949, would have been denied entry to the wineries?

The Data

However, such records of weight were available for more than 300 loads delivered to one winery.6/ Statistical tests indicated that the calculated average load weight of 9.2 tons could be applied to all loads without introduction of significant bias. Loads originated from the following counties in order of tonnage: Fresno, Tulare, Stanislaus, Merced, San Joaquin, Madera, Kings, Kern, and Santa Clara. Twenty districts in Fresno County originated deliveries to one or more of the four wineries in one or more of the three years; fourteen regions in Tulare County; eight in Stanislaus; eight in Merced; and six in San Joaquin.7/ Records sufficiently complete for analysis over the full three years were obtained for eighteen of the major varieties.8/

Method of Analysis

The implications of the questions set out above and the techniques used in answering them may be explained by reference to an example. In Figure 1, sugar readings of all loads of Thompson grapes produced in the Modesto area and received for crushing at Winery A in 1947 and in 1949 were plotted against the respective dates of delivery. Panel A is constructed from 1947 data and Panel B, from 1949 data. The two heavy horizontal lines marked "season average" indicate the two season averages of sugar content. The broken horizontal lines at equal distances above and below each of the two means bound the 95 per cent confidence intervals. The level and rate of average day-to-day changes, or intraseasonal trends, in sugar content are indicated by the two heavy lines marked "trend." Both trends in Figure 1 were significant statistically.9/ Similar averages, confidence intervals, dispersion patterns, and trends of sugar content are measured for each of the major classifications. Then, as in Figure 1, the statistical significance of differences in season averages and intraseasonal trends among the various classifications is appraised.

Season Averages and Confidence Intervals.--Even with large samples, the sample average may not be identical with the true average for all items in each classification. Therefore, for each average, the confidence interval at the 95 per cent level of probability is determined to facilitate analysis of the significance of differences among means. A confidence interval at the 95 per cent level of probability may be interpreted as follows: If many samples were drawn;

6/ There was no systematic relation between variations in tons per load and sugar content per load. Thus, absence of information on weight per load did not affect the comparability of the recorded average sugar content readings per load. The average weight per load of those lots for which tonnage was indicated was 9.2 tons. The dispersion of individual load weights around this average weight was extremely small.

7/ See Appendix Table I, Tonnage and origins of grapes delivered to Wineries A, B, C, and D, 1947-1949.

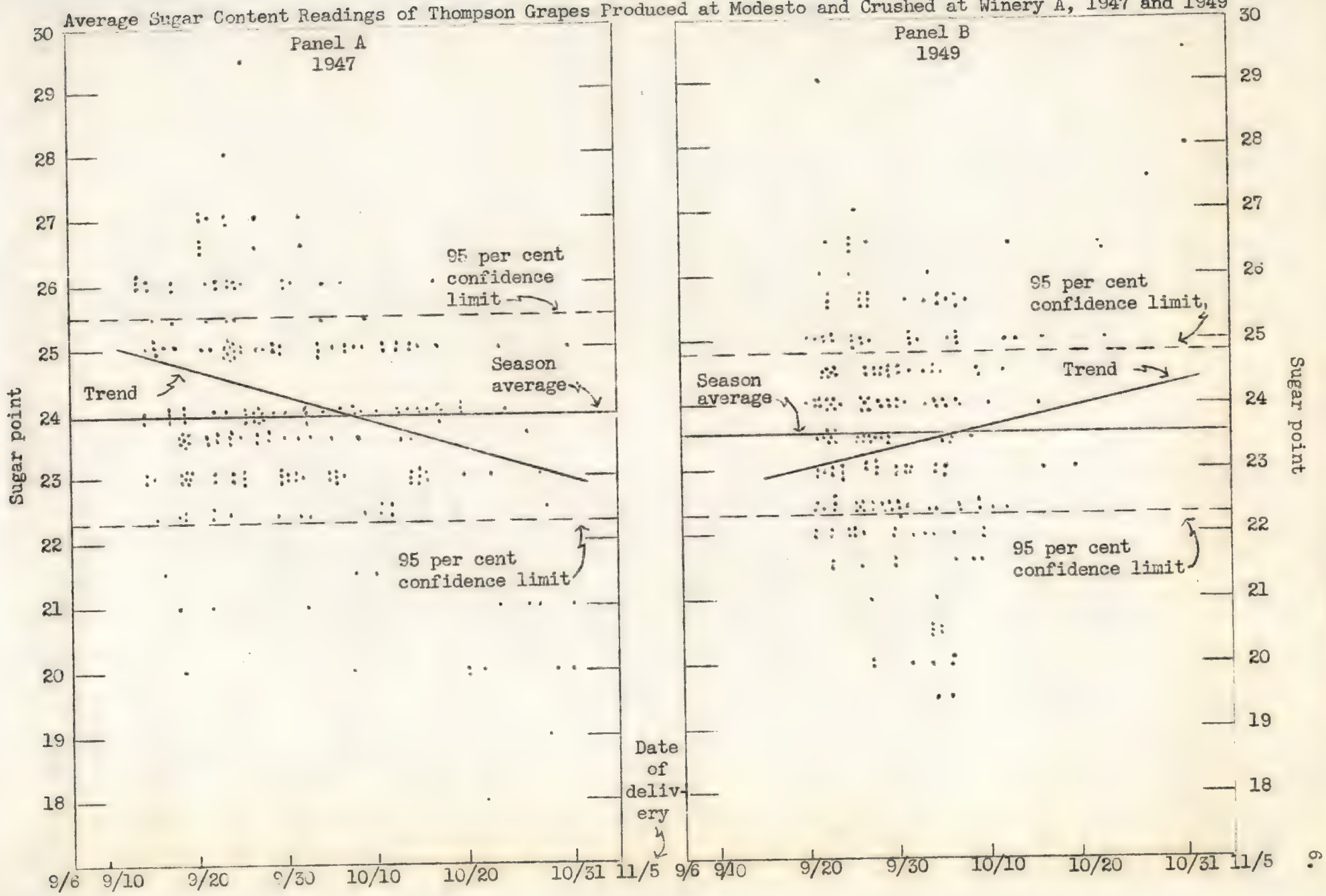
8/ These records are summarized for Wineries B and C for the years 1947 through 1949 in Tables 1 and 2, pages 13 and 14. Numbers of loads for each variety at each winery in each year are indicated. All of the major varieties crushed for wine are included.

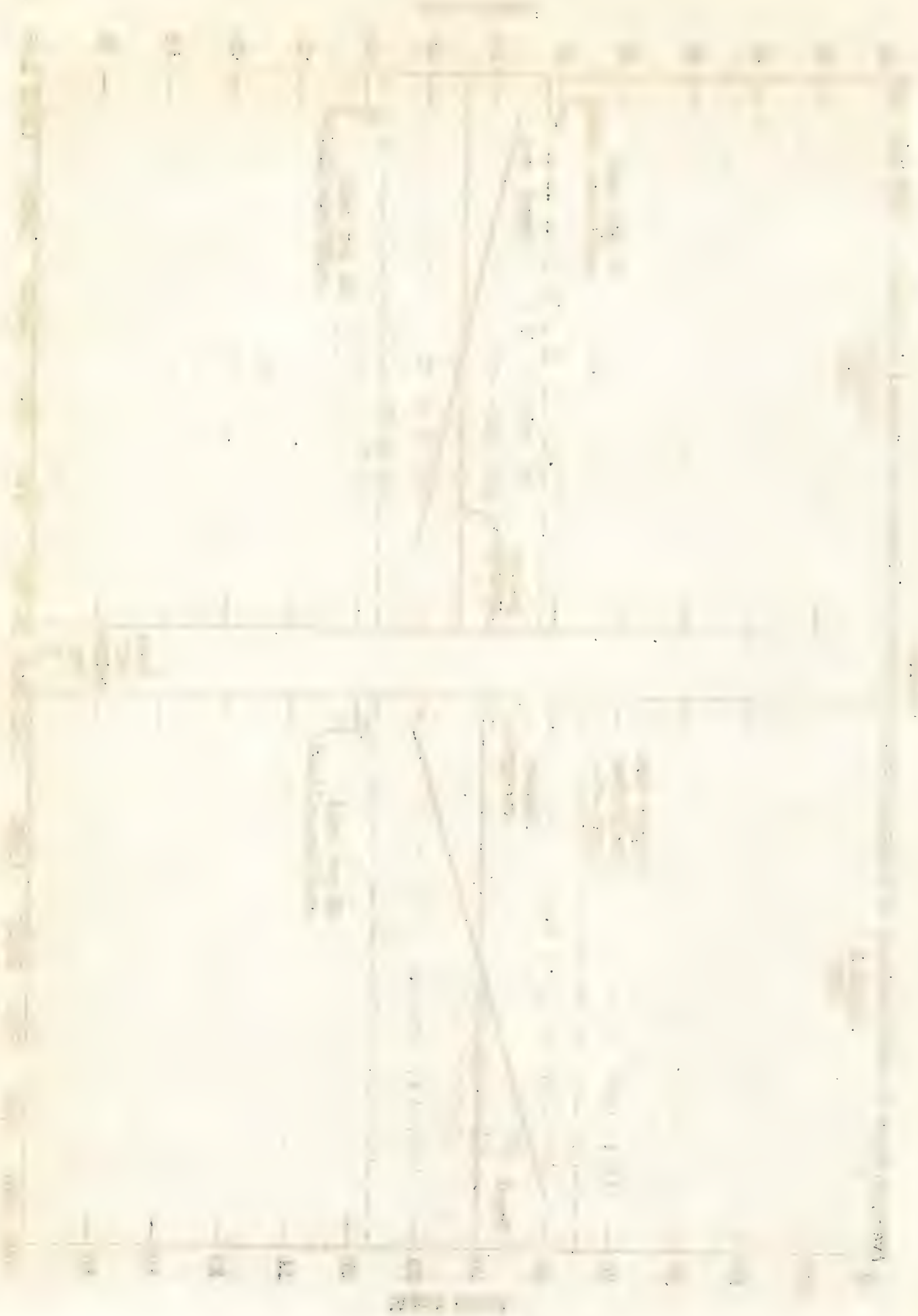
9/ This means that the probability is very low of calculating such trends out of a sample drawn from a population in which there is no intraseasonal trend. A curvilinear function might have been fitted to the 1949 data.

Method of analysis

FIGURE 1

Average Sugar Content Readings of Thompson Grapes Produced at Modesto and Crushed at Winery A, 1947 and 1949





if the average were calculated for each sample; if the confidence interval were calculated for each average; and then if, for each such interval, the statement was made that the true mean for the whole class was encompassed, 95 per cent of such statements would be correct. Thus, roughly speaking, for every nineteen correct statements that the true mean of all the items in the class was encompassed in the confidence interval calculated from the sample, there would be one statement which would not be correct.

In Figure 1, the sample season averages and the confidence intervals for the two seasons differ. However, the confidence intervals overlap. It is therefore concluded that the difference between the two means in Figure 1 is not statistically significant.10/ Differences between averages are termed significant here if the confidence intervals at the 95 per cent level of probability include no common point. If they do include a common point, it is concluded that the calculated differences may be attributed to random variations in sampling.

Variance.--The dispersion of individual load readings about the respective season average differed between the two years. Thus, a measure of the dispersion pattern--called variance--was calculated for each classification. Tests were also made to compare the significance of the differences in variances among the various sample classifications. The difference in dispersions about the two averages in Figure 1 was significant.11/

Trends and Confidence Intervals.--For many classifications, a fairly simple and stable rate of daily average change in sugar within the season was apparent. The average daily rate of change in sugar content could validly be described by a linear function in most cases.12/ With such a function, the average daily change is described as the same at all parts of the season. As noted, the trends shown in Figure 1 were significant statistically. In 1947, on the average, sugar content of Thompson grapes produced at Modesto and delivered to Winery A decreased by approximately .04 per cent daily. In 1949, the same class of grapes increased on the average of .02 per cent in sugar content daily over the season.

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10/ The significance of differences between means was also measured by "t" and "F" tests, respectively.

11/ Variances were compared by Bartlett's test. Variance for the 1947 data in Figure 1 was 2.51°; for 1949, variance was 0.89°. The standard deviations were, respectively, 1.58° and 0.94°. This means that roughly two-thirds of the 1947 observations ranged between 22.21° and 25.37° Balling. In 1949, with less dispersion, about two-thirds of the observations would have ranged between 22.67° and 24.55° Balling.

12/ These data are assumed to represent grapes harvested at or near their sugar optimum. For this reason, a growth curve or logistic was considered inappropriate. A polynomial function was used, involving fitting a series of curves to the observed data. Each term was fitted and tested for significance. Other terms were added and with each added term significance was again tested. The forms of the polynomials differed among years and varieties. In some cases, no trends were observed. In some cases, trends with as many as four significant parameters were calculated. A linear trend, with coefficient either equal or not equal to zero, was the only trend common to varieties and years tested. In most cases, there appeared to be little gain in using more complex trend equations. Hence, it was assumed that the regression of sugar content on time within the season was linear. Trends shown in the text were calculated by least squares, based on load averages. Regression coefficients so obtained were closely similar to those obtained by use of polynomials within modified data.

11/ Variances were compared by Bartlett's test. Variance for the 1917 data in observations ranged between 22.2% and 25.3% Balling. In 1919, with less dispersion, about two-thirds of the observations would have ranged between 22.0% and 24.5% Balling.

To appraise the significance of differences in average daily rates of change in sugar among the various classifications, confidence intervals about the slopes, or average rates of change, at the 95 per cent level of probability were calculated. Such confidence intervals about the calculated slopes or regressions of sugar content on time may be interpreted as follows: if many samples were drawn; if for each one a linear slope was calculated; if about this slope a confidence interval at the 95 per cent level of probability was calculated; and if a statement was made in each case that the true regression of sugar content on time was encompassed within the interval, 95 per cent of such statements would be correct. As before, if the confidence intervals of two rates of change overlap or encompass a common value, the difference between slopes is not considered statistically significant. Conversely, if there be no such common value, it is here assumed that the difference between regressions is statistically significant. Thus, in Figure 1, the regression coefficient in 1947 of sugar content upon date of delivery, or daily average rate of change in sugar, was -.039° and for 1949 was +.024°. The confidence intervals at the 95 per cent level of probability ranged from -.034° to -.044° in 1947 and from +.010° to +.038° in 1949. Since these ranges encompass no common values, it is therefore assumed that the average daily rates of change in sugar content were significantly different in the two years. Thus, these differences in trends between the two years cannot be attributed to sampling variations.

Analysis of all classifications thus involves three main procedures: (1) calculation of season average sugar content and dispersion patterns about the averages; (2) calculation of average daily rates of change in sugar content; and (3) measurement of the statistical significance of differences among means, variances, and trends for the various classifications. With these results, it is possible to appraise the effect of various sugar content minima upon total crush in the various seasons and to indicate the distribution of such limitation among wineries, areas, and varieties in the several years.

Equity and Administration.--If the data in Figure 1 were available or could themselves be predicted, it would be possible to predict tonnage of Thompson grapes produced in Modesto which would be eliminated from Winery A in consequence of any specified sugar content minimum for 1947 or for 1949. With a series representative of all grapes, calculation of both the season average sugar level and the pattern of dispersion would therefore provide data to answer the major question here: how much tonnage of grapes would be denied access to wineries as a result of any specified sugar minimum? If the season average and variance were stable over the years--which they are not--or if variations therein were systematically related to other factors which could be measured in advance of the season, tonnage could be limited precisely through specification of the sugar minimum.

But any control program based only on this skeletal information and applied to all types of grapes would involve serious administrative difficulties. If season average sugar content differed among classes--as in fact it does--the burden of elimination would be concentrated among the low sugar varieties and areas. If the dispersion patterns about the averages for varieties and areas differed widely, the impact of minimum requirements would differ among individual producers. Small increases in the required minimum sugar level could completely close the winery doors to particular varieties or areas of origin. Small changes in the required level of sugar might be associated with very large changes in the tonnage eligible for crushing. A change of 1 per cent or ½ per cent might have quite different effects depending on the level of sugar content from which the

pass a common value, the difference between slopes is not considered statistically significant. Conversely, if there be no such common value, it is here assumed that the difference between regressions is statistically significant. Thus, in figure 1, the regression coefficients in 1917 of sugar content upon date of delivery, or daily average rate of change in sugar, was -.039° and for 1919 was +.028°. The confidence intervals at the 95 per cent level of probability ranged from -.038° to -.040° in 1917 and from +.010° to +.038° in 1919. Since these ranges encompass no common value, it is therefore assumed that the average daily rates of change in sugar content were significantly different in the two years. Thus, these differences in trends between the two years cannot be attributed to sampling variations.

Analysis of all classifications thus involves three main procedures: (1) calculation of season average sugar content and dispersion patterns about the average; (2) calculation of average daily rate of change in sugar content; and (3) measurement of the statistical significance of differences among means, variances, and trends for the various classifications. With these results, it is possible to appraise the effect of various sugar content minima upon local crop varieties, areas, and varieties in the several years.

But any control program based only on this skeletal information and applied to all types of crops would involve serious administrative difficulties. The season average sugar content differed among classes--as in fact it does--the number of eliminations would be concentrated among the low sugar varieties and areas. If the dispersion patterns about the averages for varieties and areas differed widely, the degree of minimum requirements would differ among individuals. Small increases in the required minimum sugar level could completely close the winter doors to particular varieties or areas of origin. Small changes in the required level of sugar might be associated with very large changes in tonnage eligible for crushing. A change of 1 per cent or ½ per cent might have quite different effects depending on the level of sugar content from which the

change was made. If average daily sugar content changed significantly during the crushing season, a given minimum requirement could well impose different opening or closing dates or both upon different varieties or wineries or areas of origin.

Control devices must provide reasonably accurate bases to assure crushing of a specified tonnage of grapes, or at least they must assure elimination of a specified tonnage. They must also assure a reasonable distribution of burden among the various parts of the industry. Thus, two major questions must be answered: (1) are there significant differences in season average levels and in dispersion patterns about the averages among different varieties, wineries, or areas and (2) are there significant differences in the intraseasonal trends and in dispersion about trends among varieties, wineries, and areas? The first question determines whether the percentages of total output eliminated by any given minimum sugar level could be predetermined. The second question is relevant both to equity and to commercial operations of both growers and vintners. If average daily rate of change in sugar readings differed significantly among varieties, areas, seasons, and wineries, control through minimum sugar requirements would involve different opening and closing dates or both for the various areas of origin, varieties of grapes, and wineries.

Thus, analysis of these sugar content records, obtained under large-scale commercial conditions, is directed toward three issues: (1) is there sufficient similarity in average levels of sugar content and in dispersion patterns among the various classifications of grapes effectively to predict the tonnage which would be eliminated by various minima; (2) are there significant differences in average levels of sugar and in trends among varieties, areas, seasons, and wineries sufficient to engender serious equity issues; and (3) are trends such that normal periods and procedures of operation might be seriously altered?

Season Average Sugar Content

Different Varieties, One Winery, One Season.--Figure 2 may first be used to determine whether diversion or rejection percentages would differ among producers of different varieties in a single year. Season average sugar readings for each variety over the whole season are shown for Wineries B and C in each of the three years, 1947, 1948, and 1949.13/ The horizontal black lines are the 95 per cent confidence intervals for each of the varieties at each of the two wineries in each of the three years. The season average for the variety is at the mid-point of the respective confidence interval. The lengths of the confidence intervals may be taken as rough indices of the relative statistical reliability of the estimated season averages of the varietal classes. The vertical lines are season averages for all varieties at each winery in each season.14/

Thus, in 1947, the 95 per cent confidence interval for all Thompson grapes received at Winery B from all areas of origin was bounded by 23.60° and 23.75°.15/

13/ Means by varieties and years are shown in Tables 1 and 2, pages 13 and 14.

14/ The scale of Figure 2 is too small to show the actual ranges of the confidence intervals about the season averages for all grapes crushed each year at each winery. These are shown in Tables 1 and 2 on pages 13 and 14.

15/ The upper limit is the mean 23.60° plus .07. The lower limit is the mean minus .07. For Winery C, the upper limit is the mean 22.33° plus .27. The lower limit is the mean minus .27.

Season Average Sugar Content

Different Varieties, One Winery. One Season.--Figure 2 may first be used to determine whether differences or relations between grapes of different varieties in a single year. Season average sugar readings for each variety over the whole season are shown for Wineries 5 and 6 in each of the three years, 1914, 1915, and 1916.[12] The horizontal black lines are the 95 per cent confidence intervals for each of the varieties at each of the two wineries in each of the three years. The season average for the variety is at the mid-point of the respective confidence interval. The lengths of the confidence intervals may be taken as rough indices of the relative statistical reliability of the estimated season averages of the varietal classes. The vertical lines are season averages for all varieties at each winery in each season.[13]

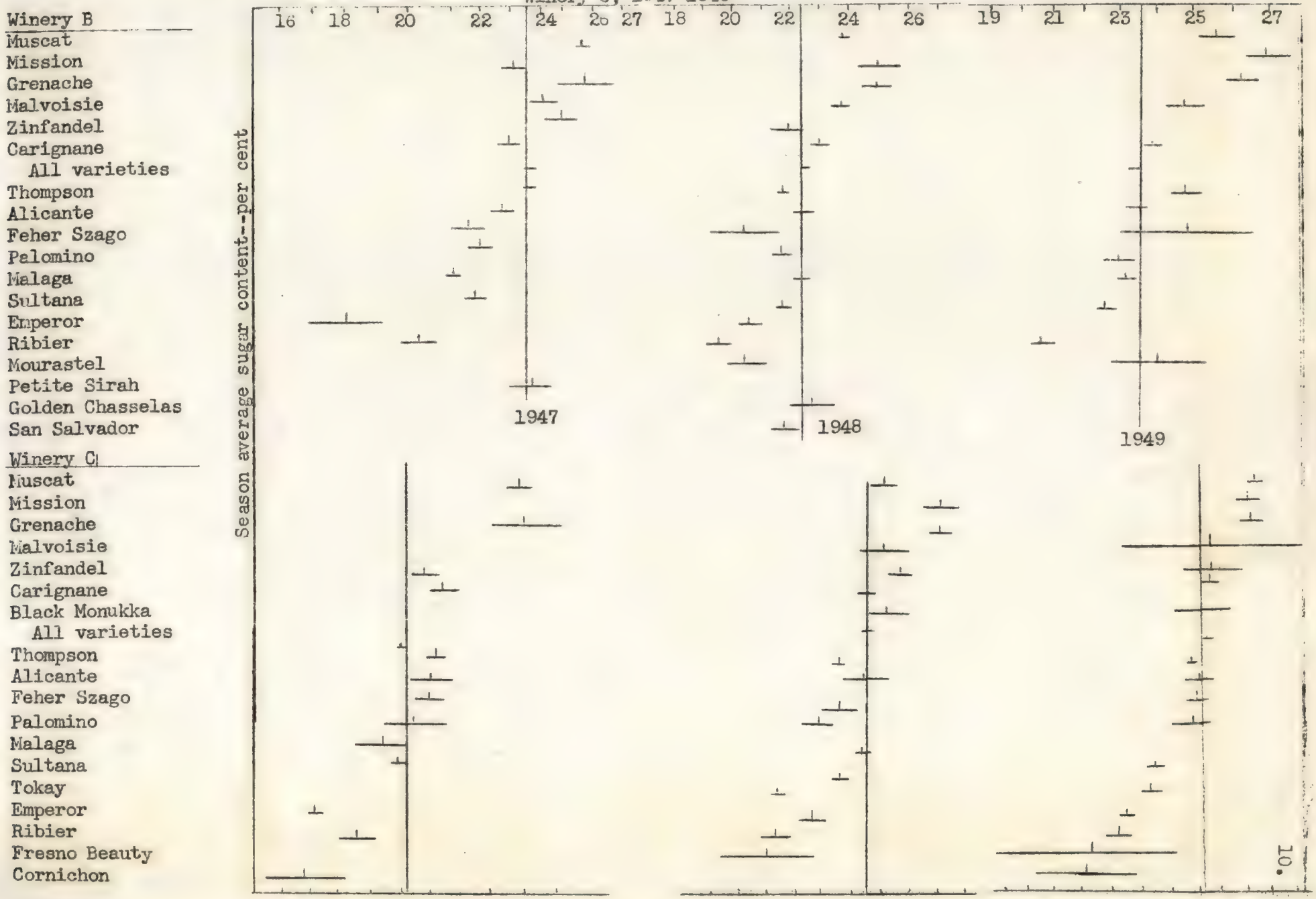
Thus, in 1917, the 95 per cent confidence interval for all Thompson grapes received at Winery B from all areas of origin was bounded by 23.60° and 23.78°.[14]

12/ Means by varieties and years are shown in Tables 1 and 2, pages 13 and 14.

13/ The scale of Figure 2 is too small to show the actual ranges of the confidence intervals about the season averages for all grapes crushed each year at each winery. These are shown in Tables 1 and 2 on pages 13 and 14.

14/ The upper limit is the mean 23.60° plus .07°. The lower limit is the mean [illegible] The lower limit is the mean minus .18°.

FIGURE 2. Estimated Season Average Sugar Content and 95 Per Cent Confidence Intervals by Varieties, Winery B and Winery C, 1947-1949



The season average sugar content in 1947 for Thompsons at Winery B was about the same as the season average for all grapes, of which Thompsons comprised a large proportion. However, the confidence interval for Thompson grapes received at Winery C in 1947 was considerably wider, bounded by 22.06° and 22.60°. The season average sugar content of Thompson grapes in 1947 differs significantly between the two wineries since their confidence intervals contain no common values. In each one of the three years, the season average sugar content for all varieties of grapes crushed differed significantly between the two wineries for again the confidence intervals do not overlap. Season average sugar for all varieties was higher for two years at Winery C and was higher in 1947 for Winery B.

Differences in season averages and daily average rates of change among the "all varieties" or other aggregated classifications may be in part attributable to the relative volume of different varieties or of grapes from different areas. To determine whether differences among the aggregated classifications were uniquely due to differences in time would require that the relative volumes of each of the varieties and areas comprising the aggregate class be held constant. Thus, if differences over time were being compared, it would be desirable that the relative weights of grapes of each variety and from each area be the same in each time period. If, in any year, differences in averages or trends of all grapes from different areas were being compared, it would be desirable to hold constant the relative volumes of the several varieties. If differences in averages or trends among wineries were being compared, it would be necessary to hold constant the relative volumes of given varieties from given areas in order to measure precisely the differences attributable to differences in receiving winery. For this analysis, however, the cause of differences among the various aggregated classes is not the most important issue. The major problem here is to determine the differences in impact of the suggested minimum sugar standards consequent upon differences in the aggregated averages or trends. So long as these measures differ among the classes, the effects of the control will also differ.

For both wineries in any one of the three years, there were wide differences in the sugar content confidence intervals for the averages of the different varieties. For Winery C in 1949, confidence intervals overlapped for eight varieties. For Winery B over three years and Winery C over two years, only eight varietal classes showed probable common season average sugar levels. Further analysis indicated that differences among season average sugar content by wineries for given varieties delivered in a single season are, in general, highly significant.16/

Thus, limitation of volume through specifying a minimum sugar content would have much different effects upon the several varieties in any single year. If the same minimum sugar content requirement were applied across the board to all varieties, then the burden of limitation would fall much more heavily on some varieties than on others. Elimination by individual wineries would be quite different in a given season.

All Varieties, One Winery, Different Seasons.--If average levels of sugar for all grapes crushed were stable from one year to the next, administration of volume control and forecasting of its impact would be greatly simplified. In Figure 2, the vertical lines for each winery for each year are the over-all season

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16/ See Appendix Tables IV and V.

The season average sugar content in 1947 for Variety C was 0.4 of a degree as the season average for all plots, or about 1 percent of the proportion. However, the confidence interval for Variety C in 1947 was considerably wider, bounded by 22.0 and 22.8, [illegible] between the two varieties since their confidence intervals do not overlap. In each one of the three years, the season average sugar content for all varieties of grapes studied significantly exceeded the two previous years. The confidence intervals do not overlap. Season average sugar for all varieties was higher for two years at Variety C and was higher in 1947 for Variety B.

Differences in season averages and daily average rates of change among the "all varieties" or other aggregated classifications may be in part attributable to the relative volume of different varieties or of grapes from different areas. To determine whether differences among the aggregated classifications were unduly due to differences in time would require that the relative volumes of each of the varieties and areas comprising the aggregate class be held constant. Thus, if differences over time were being compared, it would be desirable that the relative weights or "mixes" of each variety and from each area be the same in each time period. If, in any year, differences in average or trends of all grapes from different areas were being compared, it would be desirable to hold constant the relative volumes of the several varieties. If differences in averages or trends among wineries were being compared, it would be necessary to hold constant the relative volumes of grapes from given areas in order to measure precisely the differences attributable to difference in receiving wineries for this analysis, however, the cause of differences among the various aggregated classes is not the most important issue. The most important here is to determine the differences in level of the subsided minimum sugar standards over time upon differences in the aggregated averages or trends. So long as these measures differ among the classes, the effects of the control will also differ.

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1/ See appendix Tables IV and V.

averages of sugar content for all grapes crushed. The confidence intervals are much too narrow to show on the scale of Figure 2. However, the season average sugar levels for all varieties of grapes crushed at Winery B differed significantly between 1947 and 1948 and between 1948 and 1949. The season average sugar points for all grapes crushed at Winery C differed significantly among all of the three years.17/ The sample mean for all varieties at Winery B in 1947 as shown in Table 1 was 23.67°. The confidence interval at the 95 per cent level ranged from 23.60 to 23.75 per cent of soluble solids. The confidence interval about the season average for all varieties in 1949 ranged from 23.50 to 23.84 per cent. Since these two ranges overlap, the differences in the two seasonal averages are not considered statistically significant. However, in 1948 the confidence interval ranged from 22.42 to 22.54 per cent. Since this range does not overlap with either the 1947 or the 1949 ranges, it is considered that the 1948 all variety season average for Winery B differs significantly from the 1947 and 1949 averages.

The seasonal averages and confidence intervals for Winery C are shown in Table 2. The calculated averages for all varieties are 21.09° in 1947, 23.45° in 1948, and 25.28° in 1949. The differences among the season averages are all statistically significant. There is little likelihood that the recorded differences are due to sampling variations.18/

Thus, to apply any given sugar content minimum over several seasons would often involve important year-to-year differences in the proportion of annual total deliveries to any winery which was denied access to the crushing outlet.

All Varieties, Different Wineries, One Season.--Figure 2 also demonstrates that the season averages for all varieties crushed in each of the three years differ significantly between Winery B and Winery C. The relative impact of volume control through minimum sugar requirement would, therefore, be different between the two wineries in each of the three years.19/ In 1947 the confidence interval for all grapes crushed at Winery B ranged from 23.60 to 23.75 per cent; the range for Winery B was from about 21.1 to 21.2 per cent. In 1948 the situation was reversed, with average sugar content of all grapes delivered to Winery B centering about 22.5 per cent, with a season average of about 23.5 per cent for Winery C. Confidence intervals for 1948 did not overlap. In 1949 average sugar was higher than in both preceding years, but the mean for Winery C was well over 25 per cent while for Winery B it was only a little over 23.5 per cent. Again, confidence intervals did not overlap.

These differences in confidence intervals about the sample averages are indicated in Figure 3 for a number of major varieties crushed at three wineries in 1947. The three horizontal lines in the row designated "all varieties" have no common values. Thus, for all grapes received, the confidence interval for the average sugar content centers closely about 21 per cent for Winery C; for

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17/ These relationships may also be calculated from Tables 1 and 2. For any classification, the confidence interval is the mean plus and minus the appropriate entry in the confidence interval columns.

18/ Highly significant chi-square values for Winery B and Winery C were obtained. Chi-square values for all varieties and for each major variety separately are shown in Appendix Table IV.

19/ Unless differences in averages were exactly counterbalanced by differences in dispersion patterns.

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[illegible]

nearly between 1917 and 1918 and between 1918 and 1919. The season average sugar contents for all grapes crushed at Winery C differed significantly among all of the three years.17/ The sample mean for all varieties at Winery B in 1917 as shown in Table 1 was 23.67%. The confidence interval at the 95 per cent level ranged from 23.60 to 23.75 per cent of soluble solids. The confidence interval about the season average for all varieties in 1918 ranged from 23.50 to 23.68 per cent. Since these two ranges overlap, the differences in the two seasonal averages are not considered statistically significant. However, in 1918 the confidence interval ranged from 22.42 to 22.58 per cent. Since this range does not overlap with either the 1917 or the 1919 ranges, it is considered that the 1918 all variety season average for Winery B differs significantly from the 1917 and 1919 averages.

The seasonal averages and confidence intervals for Winery C are shown in Table 2. The calculated averages for all varieties are 21.09% in 1917, 23.42% in 1918, and 25.28% in 1919. The differences among the season averages are all statistically significant. There is little likelihood that the recorded differences are due to sampling variations.18/

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18/ Highly significant chi-square values for Winery B and Winery C were obtained. Chi-square values for all varieties and for each major variety separately are shown in Appendix Table IV.

[illegible]

in differentiation patterns.

TABLE 1

Estimated Season Average Sugar Content, 95 Per Cent Confidence Intervals and Variances, by Varieties, Winery B, 1947-1949

Variety	Number of loads			Mean sugar			Confidence interval[a]			Variances		
	1947	1948	1949	1947	1948	1949	1947	1948	1949	1947	1948	1949
Alicante	318	150	154	22.81	22.27	23.57	.1829	.3451	.3075	2.75	4.58	3.73
Carignane	141	218	130	23.27	22.87	24.12	.2612	.2602	.3182	2.46	3.80	3.36
Emperor	22	41	363	17.90	20.49	20.93	1.1104	.4931	.1545	6.27	2.44	2.24
Feher Szago	71	17	10	21.70	20.38	24.96	.4723	1.1746	1.9097	3.98	4.91	6.42
Golden Chasselas		7			22.26			.7982			.64	
Grenache	18	43	25	25.62	24.79	26.14	.7553	.4718	.4121	2.18	2.34	1.00
Malaga	261	350	230	21.19	22.26	23.30	.1756	.1364	.1836	2.08	1.68	1.99
Malvoisie	56	69	19	24.30	23.49	24.66	.4774	.4688	.6229	3.16	3.81	1.58
Mission	19	21	28	23.33	24.95	26.92	.2780	.6629	.6499	.31	2.12	2.81
Mourastel		11	7		20.17	23.96		.7694	1.2344		1.12	5.42
Muscat	781	985	562	25.65	23.84	25.54	.1125	.0360	.4493	2.57	.33	1.16
Palomino	102	89	46	22.30	21.45	23.03	.2418	.3432	.4657	1.52	2.65	2.46
Petite Sirah	13			23.88			.8184			1.69		
Ribier	34	60	71	20.16	19.42	20.62	.4374	.3508	.2739	1.58	1.85	1.34
San Salvador		7			21.59			.6913			.48	
Sultana	111	100	95	22.16	21.60	22.75	.3012	.2394	.2341		1.46	1.32
Thompson	1,013	1,416	106	23.68	21.78	24.97	.0735	.0871	.2944	1.42	2.79	2.33
Zinfandel	44	33		24.65	21.79		.5354	.6099		3.11	2.94	
All varieties	3,004	3,617	1,846	23.67	22.48	23.67	.075	.060	.170	4.47	3.20	13.95

a/ The confidence interval is determined by addition and subtraction of the entry to the appropriate mean. Thus, the confidence intervals for Alicantes are: 1947, 22.81 ± .1829; 1948, 22.27 ± .3451; 1949, 23.57 ± 30.57.

TABLE 2

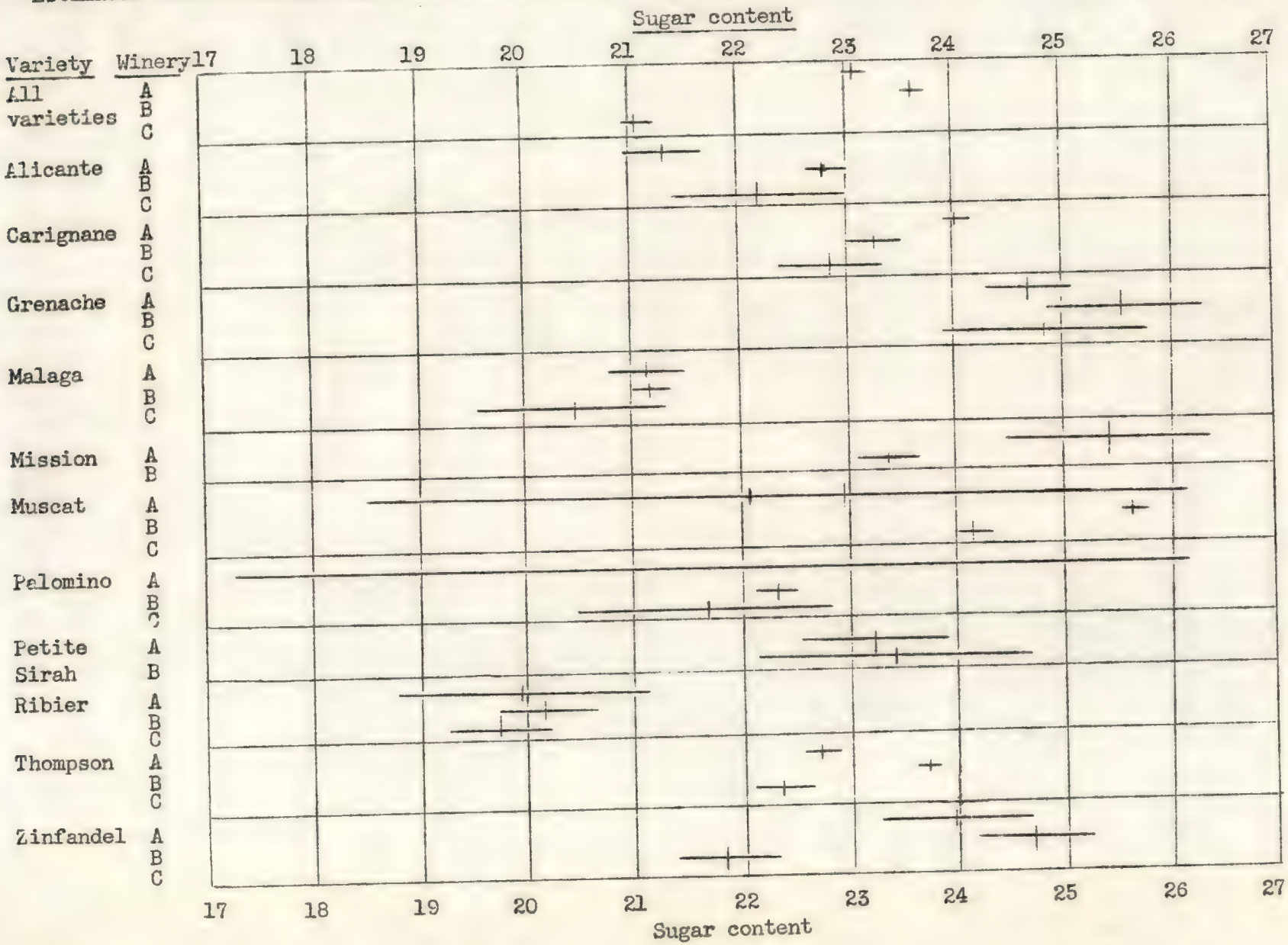
Estimated Season Average Sugar Content, 95 Per Cent Confidence Intervals and Variances, by Varieties, Winery C, 1947-1949

Variety	Number of loads			Mean sugar			Confidence interval			Variances		
	1947	1948	1949	1947	1948	1949	1947	1948	1949	1947	1948	1949
Zinfandel	6	77	20	21.83	24.77	25.37	.431	.456	1.268	.14	4.05	6.98
Cornichon	8		5	17.88		20.98	1.478		1.865	2.73		1.81
Grenache	11	93	178	24.86	25.93	27.08	.927	.370	.3345	1.73	3.23	5.12
Palomino	18	46	81	21.69	21.89	24.69	1.173	.339	.6436	5.26	1.301	8.48
Carignane	42	177	335	22.74	23.63	25.36	.474	.253	.2942	2.31	2.91	7.49
Feher Szago	34	34	106	22.14	22.50	24.99	.644	.640	.3174	3.42	3.38	2.71
Alicante	29	22	111	22.20	23.46	25.00	.795	.837	.4004	4.37	3.56	4.52
Ribier	46	44	64	19.76	20.35	22.23	.420	.413	.4720	2.00	1.85	2.92
Thompson	136	1,044	451	22.33	22.76	25.02	.268	.082	.1272	2.49	1.83	1.89
Emperor	433	29	326	18.30	21.59	22.34	.130	.469	.2009	1.90	1.52	3.40
Sultana	142	106	154	20.94	22.61	23.48	.201	.241	.2930	1.48	1.56	3.38
Muscat	538	1,382	910	24.16	24.34	27.23	.152	.569	.1001	3.24	11.16	2.37
Malaga	934	434	752	20.34	23.44	24.55	.840	.135	.1253	1.71	2.04	3.07
Fresno Beauty		9	5		19.99	21.12		1.665	3.139		4.16	5.12
Black Monukka		29	11		24.28	25.32		.730	1.403		3.69	3.96
Malvoisie		20	70		24.17	25.49		.914	3.3328		3.62	1.95
Tokay		186	7		20.55	23.30		.158	.450		1.18	.20
Mission		21	46		26.04	27.20		.564	.5283		1.54	3.16
All varieties	2,377	3,753	3,632	21.09	23.45	25.28	.10	.20	.10	6.31	6.74	9.33

Estimated Season Average Sugar Content of Tea Corn Conference Interval

FIGURE 3

Estimated Season Average Sugar Content and 95 Per Cent Confidence Intervals, by Varieties, Wineries A, B, and C, 1947



Winery A, a little above 23 per cent; and for Winery B, about ½ per cent higher. Similarly, as noted above, there is no overlap of the "all varieties" confidence intervals about the season averages for Wineries B and C in 1948 and in 1949.20/

Thus, it is impossible to accept the hypothesis that in any year the overall average sugar content of grapes received by different wineries is the same. The likelihood is very low that the recorded differences in the all variety averages among different wineries in 1947 could be calculated out of samples drawn from basic data in which no such differences exist. Thus, volume control on the basis of sugar content would involve differential impact upon different wineries within a single season.21/

One Variety, One Winery, Different Seasons.--If season average sugar content of one variety at one winery is significantly different from one year to another, volume control would normally mean different varietal percentages of elimination. Season averages of sugar content for major varieties are shown for two wineries and for each of three years in Figure 2 and in Tables 1 and 2. There is an obviously close relationship in the ranking of the several varieties in terms of sugar content, either between years at the same winery or between wineries in the same season. Season average sugar content by varieties and for different seasons are also recorded in Tables 1 and 2. Further analysis of these differences by other methods indicates that the varietal averages for all of the three years differ significantly.22/ The statistical inference is, therefore, that the same variety received at the same winery differs significantly in sugar from one year to another. Thus, even at the same winery, tonnage eliminated by a given minimum sugar requirement would differ sharply from one season to another for most of the varieties.

One Variety, Different Wineries, One Season.--Figure 3 represents the estimated season average sugar content for three wineries and for twelve varieties with mean confidence intervals at the 95 per cent level of probability for the 1947 season. It is concluded that averages were not significantly different among the different wineries in 1947 for the following varieties: Grenache, Malaga, Palomino, and Ribier. Season sugar content averages recorded in 1947 differed significantly among wineries for the following varieties: Alicante, Carignane, Mission, Muscat, Thompson, and Zinfandel. Comparisons between Wineries B and C for the three seasons, 1947, 1948, and 1949, are shown in Figure 2 for other varieties.

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20/ These data are also shown in the rows designated "all varieties" in Tables 1 and 2. The relative lengths of the lines in Figure 3 may be taken as rough indices of the relative reliability of the sample means. The season average estimate is the mid-point of the line indicating the confidence interval.

21/ The differences between the season average sugar percentages among Wineries A, B, and C in 1947 were tested by chi-square procedures. A highly significant chi-square magnitude was obtained. These data are shown in Appendix Table V. A "t" test of differences in average sugar content between Wineries B and C in 1948 yielded an insignificant magnitude. The "t" value for differences in all variety averages between Wineries B and C for 1949 resulted in a significant "t" value. It must, therefore, be concluded that the season average sugar content for all grapes crushed in a single year is generally not the same for different wineries.

22/ The significance of differences among varietal averages over the years 1947, 1948, and 1949 was tested for major varieties at both Wineries B and C. It is concluded that the varietal averages differ significantly over time. These results are shown in Appendix Table IV.

In general there are significant differences in average seasonal sugar content for the same variety delivered in the same season to different wineries, largely attributable to differences in average sugar content of a given variety from different areas. Further analysis by other methods supports the view that significant differences in sugar by varieties exist among the various wineries in any given season.23/ Thus, across-the-board minimum requirements on given varieties would differentially affect the several wineries in any given year.

Varietal Rankings Among Wineries and Seasons.--The varieties crushed at one winery in one season can be ranked in terms of season average sugar content in an order which will also generally prevail for other wineries or for other seasons. Figure 2 indicates considerable stability in the ranking of average sugar by varieties among different wineries and over different seasons. Ten varieties crushed at both Winery B and Winery C in the years 1947-1949 were ranked according to estimated average sugar content as shown in Table 3. The degree of rank

TABLE 3

Rankings of Varieties in Season Average Sugar Content, Two Wineries, 1947-1949a/

Variety	Winery B			Winery C		
	1947	1948	1949	1947	1948	1949
Emperor	13	11	12	11	10	10
Feher Szago	10	12	4	6	9	5
Mission	5	1	1			
Palomino	8	10	10			
Malvoisie	3	4	6			
Grenache	2	2	2	1	1	2
Ribier	12	13	13	10	11	11
Sultana	9	9	11	8	8	9
Muscat	1	3	3	2	3	1
Alicante	7	6	8	5	5	5
Carignane	5	5	7	3	4	3
Malaga	11	6	9	9	6	8
Thompson	4	8	4	4	7	5
Zinfandel				7	2	3

a/ The variety with the highest season average sugar content in each winery is recorded as 1; the next highest as 2; etc. Two varieties having the same sugar point level are given the same rank. However, the following variety assumes its correct rank variety. For example, two varieties with rank 5 would be followed by a variety with rank 7.

23/ The chi-square value for all grapes, all Thompsons, all Malagas, and all Carignanes in 1947 and for all Thompsons in 1949 for Wineries A, B, and C, is shown in Appendix Table V. All differences are significant. Differences between averages were also tested for Winery B and Winery C with respect to all varieties in 1948 and 1949; Thompsons in 1948; Malagas, Muscats, and Carignanes in 1948 and 1949. All "t" values indicate highly significant differences. These are shown in Appendix Table V.

each variety is recorded as 1; the next highest as 2; etc. the same rank. However, the following example illustrates how correct rank varieties. For example, two varieties with rank 5 would be followed by a variety with rank 7.

correlation was found to be considerably higher than could be expected to occur by chance.24/ Thus, while the absolute average levels of sugar for given varieties differ in magnitude among wineries and over seasons, the varietal ranks of average sugar content by varieties remain fairly constant over seasons and among different wineries within given seasons. Volume control by minimum sugar requirement would mean different tonnages and percentages of total production of each variety eliminated for the several wineries in a given season and over seasons for a given winery. However, the order in which the degree of limitation would be ranked by varieties would be essentially constant over time and among wineries.

Areas of Origin.--In the preceding paragraphs the degree and significance of differences in season average sugar content have been related to differences in receiving wineries, in varieties, and in seasons. Next there is a test of a tentative hypothesis that there are significant differences between lots of the same variety from different regions of production, even when delivered to a single winery in a single season. A second hypothesis is also tested in this section--that there are significant differences in the season average sugar content of all grapes delivered to a single winery in a single season from different areas of production. Then the significance of differences in season average sugar content among different production areas over different seasons is tested.

Figure 4 indicates season average sugar content for all Thompson grapes received at Winery A in 1949, classified by areas of origin. Nine areas of production are analyzed. The horizontal lines again indicate confidence intervals about the sample means at the 95 per cent level. The season average calculated from the sample for each area is at the mid-point of the confidence interval. The relative lengths of the confidence intervals may be taken as rough indices of the relative reliability of the sample averages. Even for this single variety received in a single season at a single winery, there is considerable variation among nearby areas. A similar analysis was also made of variations in season average sugar of Thompson grapes received from different areas by Winery A in 1947.25/ The differences among the seasonal sugar content of the same variety from different areas were found to be highly significant. Alternatively, there is very low likelihood of chance occurrence of such sample differences between areas in which the actual differences were zero. Therefore, it was necessary to reject the hypothesis that there are no differences between areas for the same variety in the same year and even at the same winery.

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24/ Spearman's coefficients of rank correlation ranged from P = .66 to P = .88, with ranks for both wineries correlated as follows: 1947 versus 1948, 1947 versus 1949, and 1948 versus 1949; and with ranks for Winery B compared with ranks for Winery C in each of the three years. Probability of occurrence of such coefficients by chance from a population in which rank correlation was zero was very low. These measured are summarized in Appendix Table VI.

25/ Chi-square analysis indicated that the differences among means by areas of origin were highly significant. See Appendix Table VII. Means and variances of major varieties, classified by area of origin and by receiving winery, are also shown in Table 10.

correlation was found to be considerably higher than could be expected to occur by chance.[24] Thus, while the absolute average levels of sugar for given varieties differ in magnitude among wineries and over seasons, the varietal ranks of average sugar content by wineries remain fairly consistent over seasons and among different wineries within given seasons. Volume control by wineries over responsement would mean different tonnages and percentages of total production of each variety obtained for the several wineries in a given season and over seasons for a given winery. However, the extent to which the degree of limitation would be removed by varieties would be essentially constant over time and among wineries.

Areas of Origin.--In the preceding paragraphs the degree and significance of differences in season average sugar content have been analyzed to differences in receiving wineries, in varieties, and in seasons. Next there is a test of a tentative hypothesis that there are significant differences between lots of the same variety from different regions of production, even when delivered to a single winery in a single season. A second hypothesis is also tested in this section--that there are significant differences in the season average sugar content of all grapes delivered to a single winery in a single season from different areas of production. Then the significance of differences in season average sugar content among different production areas over different seasons is tested.

Figure 3 indicates season average sugar contents for all Thompson Seedless received at Winery A in 1940, classified by areas of origin. Nine areas or more production are analyzed. The horizontal lines again indicate confidence intervals about the sample means at the 95 per cent level. The season average calculated from the sample for each area is at the mid-point of the confidence interval. The relative lengths of the confidence intervals may be taken as rough indices of the relative reliability of the sample averages. Even for this single variety received in a single season at a single winery, there is considerable variation among nearby areas. A similar analysis was also made of variations in season average sugar of Thompson grapes produced from different areas by Winery A in 1939.[25] The difference among the seasonal sugar contents of the same variety from different areas were found to be highly significant. Alternatively, there is very little likelihood of chance occurrence of such samples as those for Winery A in 1940. [illegible] it was necessary to reject the hypothesis that there are no differences between areas for the same variety in the same year and even at the same winery.

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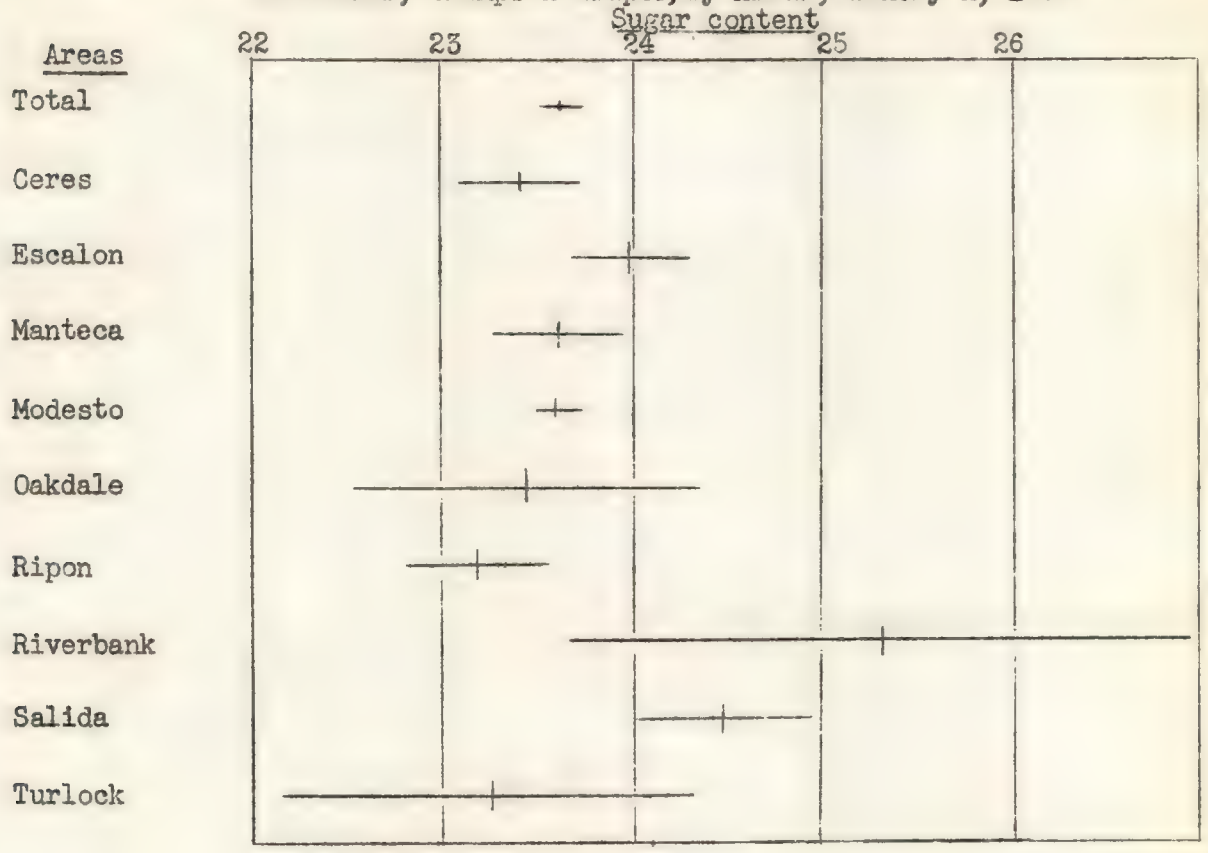
[24] Spearman's coefficients of rank correlation ranged from P = .66 to P = .88, with ranks for both wineries correlated as follows: 1939 versus 1940, 1939 versus 1938, and 1938 versus 1940; and with ranks for Winery B compared with ranks for Winery C in each of the three years. Probability of occurrence of such coefficients by chance from a population in which rank correlation was zero was very low. These measures are summarized in Appendix Table VI.

[illegible] of origin were highly significant. See Appendix Table VII. Means and variances of major varieties, classified by area of origin and by receiving winery, are also shown in Table IX.

FIGURE 4

Estimated Season Average Sugar Content and 95 Per Cent Confidence Intervals, Thompson Grapes, by Areas, Winery A, 1949



Season average sugar content by thirty-one areas of origin for all grapes crushed by Winery C are shown in Table 4. Two conclusions are immediately apparent. First, there are wide differences in the season averages among areas of origin when all varieties of grapes from each area are consolidated. These differences may be attributable to at least two sources of variation: (1) proportions of total area production comprised by the various varieties and (2) weather, soil, or cultural practices. For those series in which a single variety delivered to a single winery in a single year was sorted by areas of origin and receiving winery, the resulting differences in season averages by areas of origin were found to be significant statistically. The data in Table 4 also indicate that there are wide differences in season average sugar by areas from one year to another. The same conclusions are applicable to the variances.

Variances.--As noted, to calculate the tonnage of grapes which would be eliminated by variety, by area of origin, by receiving winery, and by season consequent upon any specified grape sugar minimum, knowledge of both the means and the variances, or patterns of dispersion of individual load readings about the season average, of each classification was necessary. Season averages for any two classifications might be identical, but the tonnage eliminated would differ if the dispersion of individual loads about the identical means differed in the two classes. Therefore, tests were made of several aspects of the dispersion patterns about season averages: (a) among varieties; (b) among wineries; (c) among areas of origin; and (d) over time.

The variances--or standard deviations squared--are shown by varieties and areas of origin for Winery B in Table 5. They are also shown for Winery A in 1947 and for Wineries B and C over 1947-1949 in Table 6. These variances may be taken for each series separately as a measure of the dispersion of the individual observations about the sample mean of the class.

Tests were first made to determine whether for a given winery and a given season the dispersion patterns of individual load readings about the season averages of individual varieties differed significantly.26/ Records for all varieties crushed at Winery B in 1948 and 1949 were analyzed. Differences in dispersion patterns were statistically significant.27/

In general, for given varieties crushed at Winery B, the sample variances varied from year to year. There appear to be no trends in these indices of dispersion. Differences in dispersion about the varietal means from one year to another were statistically significant.28/

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26/ Tests for the influence of variety on variance for grapes were applied to the following varieties for Winery A for 1947: Alicante, Carignane, Golden Chasselas, Grenache, Malaga, Mission, Palomino, Petite Sirah, Ribier, San Salvador, Thompson, Tokay, and Zinfandel. The "F" values indicated that the varieties differed significantly. Variances by areas of production for Winery C are shown in Table 4. Variances by variety are shown for five areas in Table 5. Further breakdowns are shown in Table 10.

27/ Bartlett's test of homogeneity of variances among samples differing in size was applied to Winery B for the following varieties: Thompson, Carignane, Emperor, Alicante, Malaga, Ribier, Muscat, Mourastel, Feher Szago, Malvoisie, Mission, Grenache, Palomino, and Sultana. The χ^2 value for 1948 was 1,166.52 and for 1949 was 13,965.03. Thus, in both years there were highly significant differences in the dispersions among these varieties received at a single winery.

28/ Bartlett's test for homogeneity of variances indicated that the differences in variances from one season to another were significant.

Season average sugar content by thirty-one areas of origin for all grapes of Winery C are shown in Table 4. Two conclusions are immediately apparent. First, there are wide differences in the season averages among areas of origin delivered to a single winery in a single year was sorted by areas of origin receiving winery, the resulting differences in season averages by areas of origin were found to be significant statistically. The data in Table 4 also indicate that there are wide differences in season average sugar by areas from one year to another. The same conclusions are applicable to the variances.

Variances.--As a method to calculate the tonnage of grapes which would be delivered by variety, by area of origin, by receiving winery, and by setting caused upon any specified grape sugar minimum, knowledge of both the mean and the variances, or patterns of dispersion of individual load readings about the season average, of each classification was necessary. Season averages for any two classifications might be identical, but the tonnage eliminated would differ if the dispersion of individual loads about the identical means differed in the two classes. Therefore, tests were made of several aspects of the dispersion patterns about season averages: (a) among varieties; (b) among wineries; (c) among areas of origin; and (d) over time.

The variances--or standard deviations squared--are shown by varieties and areas of origin for Winery B in Table 5. They are also shown for Winery A in 1947 and for Wineries B and C over 1946-1949 in Table 6. These variances may be taken for each series separately as a measure of the dispersion of the individual observations about the sample mean of the class.

Tests were first made to determine whether for a given winery and a given season the dispersion patterns of individual load readings about the season averages of individual varieties differed significantly.[26] Records for all varieties crushed at Winery B in 1946 and 1949 were analyzed. Differences in

In general, for given varieties crushed at Winery B, the sample variance varied from year to year. There appear to be no trends in these indices of dispersion. Differences in dispersion about the varietal means from one year

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[26] Tests for the influence of variety on variance for grapes were applied to the following varieties for Winery A for 1947: Alicante, Carignane, Golden Chasselas, Tokay, and Zinfandel. The "F" values indicated that the variation differed significantly. Variances by areas of production for Winery C are shown in Table 4. Variances by variety are shown for five areas in Table 5. Further breakdowns are shown in Table 10.

[27] Bartlett's test of homogeneity of variances among samples differing in size was applied to Winery B for the following varieties: Thompson, Carignane, Alicante, Grenache, Palomino, and Sultana. The χ^2 value for 1949 was 1,166.52 and for 1947 was 1,965.09. Thus, in both years there were highly significant differences in the dispersions among these varieties received at a single winery.

in variances from one season to another were significant.

TABLE 4

Estimated Season Average Sugar Content, and Variances,
All Varieties, by Areas of Origin, Winery C, 1947-1949

Area	1947		1948		1949	
	Mean	Variance	Mean	Variance	Mean	Variance
Caruthers	19.9	.7	21.4	.3	a/	
Clotho					24.6	16.0
Clovis	21.3	5.2	23.9	2.0	24.5	5.0
Del Rey	23.4	3.4	23.5	1.9	25.0	4.4
Dinuba	19.6	2.7	21.6	31.9		
Exeter	18.8	2.8	23.1	1.7	23.2	6.9
Fowler	22.0	4.3	23.4	3.0	25.1	5.0
Fresno	21.2	6.5	23.5	3.0		
Hanford			24.6	2.2	27.2	13.3
Herndon	21.0	1.5				
Hughson			21.5	2.0	24.1	.48
Ivanhoe	18.6	2.8	22.8	2.7	24.6	2.2
Kerman	21.0	2.3	22.6	1.2	28.3	3.1
Kingsburg	22.1	6.2	23.8	2.0	25.9	3.2
Laton					24.7	.6
Lemoore			23.2	1.4		
Lodi	23.6	4.3	21.4	3.7		
Madera	21.4	6.8	22.4	1.2	23.7	2.4
Merced					25.2	.04
Modesto			22.9	1.9		
Orange Cove					23.0	5.6
Parlier	23.5	5.4	24.3	3.5	25.6	10.9
Reedley	20.2	11.1	24.4	2.8	26.4	7.0
Ripon			21.3	.2		
Salida			22.4	1.1		
Sanger	20.8	3.9	23.0	2.7	24.9	4.1
Selma	22.7	5.8	23.9	1.9	25.6	4.5
Terra Bella					27.0	3.3
Turlock			25.7	8.4	25.1	3.2
Visalia	17.9	1.4			25.8	.3
Winton			23.2	3.0	25.1	6.4
All areas	21.09		23.45		25.28	

a/ Blanks indicate inadequate data or no data for the indicated area and year. Breakdowns by area, variety, winery, and year are shown in Table 10.

Estimated Season Average Sugar Content, and Variances, All Varieties, by Areas of Origin, Winery C: 1947-1950

Area	1947	1948		1949	
	Average	Mean	Variance	Mean	Variance
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	21.3	23.9	2.0	[illegible]	[illegible]
[illegible]	23.4	23.5	1.9	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	26.3	24.2	1.7	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	3.0	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	24.5	2.9	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	24.5	2.0	[illegible]	[illegible]
[illegible]	[illegible]	22.8	2.1	[illegible]	[illegible]
[illegible]	[illegible]	22.6	1.2	[illegible]	[illegible]
[illegible]	[illegible]	23.3	2.0	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	24.0	2.7	[illegible]	[illegible]
[illegible]	[illegible]	23.4	1.6	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	22.9	1.9	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	24.3	3.5	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	2.8	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	1.2	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	2.7	[illegible]	[illegible]
[illegible]	[illegible]	23.9	1.5	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	23.2	3.0	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

1/ Plants in these localities were [illegible] the varieties and [illegible] breakdowns by area, variety, winery, and year are given in Table 10.

TABLE 5

Estimated Season Averages and Variances of Sugar Content by Areas of Origin, Year, and Variety, Winery B, 1947-1949[a]/

Area and variety	Loads tested			Mean sugar level			Variance		
	1947	1948	1949	1947	1948	1949	1947	1948	1949
				per cent					
Sanger									
Muscat	41	130	103	25.3	24.0	26.5	4.1	1.6	1.6
Thompson	205	216	20	24.1	22.2	25.0	1.0	2.1	1.2
Sultana	11	33	27	22.5	21.7	23.0	.7	1.2	1.8
Malaga	72	70	60	22.0	22.6	23.3	1.5	1.7	1.7
Alicante	63	37	52	22.5	22.2	23.7	2.3	3.1	2.6
Carignane	20	25	30	23.7	22.5	23.2	2.6	2.2	2.2
Emperor	9	7	56	18.4	20.3	21.6	8.7	2.8	1.6
Dinuba									
Muscat	26	44	115	26.5	23.5	26.4	2.2	1.3	1.3
Thompson	29	145	12	23.0	20.9	24.9	1.4	3.1	1.1
Sultana	22	9	14	21.2	21.8	23.0	1.5	1.4	3.0
Malaga	11	29	28	20.2	21.7	23.6	.4	1.3	4.0
Fresno									
Muscat	18	51	65	27.1	26.9	23.8	5.6	1.5	2.0
Thompson	37	12	42	23.2	25.0	22.4	1.0	3.1	1.4
Malaga		21	10		23.0	22.3		1.4	.8
Alicante	18	27	14	23.3	24.2	23.6	2.6	2.1	5.1
Carignane		19	53		25.4	24.3		6.4	1.8
Kingsburg									
Muscat	256	48	67	25.8	24.2	26.5	2.2	1.6	3.1
Thompson	57	57	5	24.2	21.9	23.7	1.4	2.9	1.6
Sultana	32	14		22.7	21.3		1.9	1.9	
Malaga	18	23	21	20.9	22.4	23.1	1.0	.9	1.2
Carignane	9	9		24.1	22.3		6.2	1.0	
Reedley									
Muscat	131	207	89	25.5	23.9	26.4	3.1	2.5	9.2
Thompson	290	246	19	23.6	22.0	25.0	1.5	2.7	.4
Sultana	22	10	41	22.7	21.0	20.8	2.1	.7	.7
Alicante	201	51	40	22.8	21.1	24.1	2.6	1.9	3.8
Carignane	65	8	26	22.9	23.6	23.8	1.9	.4	1.2
Emperor	7	16	60	18.2	20.1	21.0	8.4	3.2	2.1
Malaga	105	89	31	20.8	22.3	22.9	2.3	2.0	2.9

a/ See Table 10 for other breakdowns by area, variety, and winery.

TABLE 5

Estimated Season Averages and Variances of Sugar Content by Areas of Origin, Year, and Variety, Ninety 3, 1957-1962 1/

Area of origin	Year	Variety	Sugar content	Variance

1/ See Table 10 for other breakdowns by area, variety, and ninety.

TABLE 6

Variance of Estimated Season Average Sugar Content by Varieties and Wineries, 1947-1949

Variety	Winery A	Winery B			Winery C		
	1947	1947	1948	1949	1947	1948	1949
Alicante	3.3	2.75	4.58	3.73	4.4	3.6	4.5
Black Monukka						3.7	4.0
Carignane	2.4	2.46	3.80	3.36	2.3	2.9	7.5
Cornichon					2.7	2.9	1.8
Emperor		6.27	2.44	2.24	1.9	1.5	3.4
Feher Szago		3.98	4.91	6.42	3.4	3.4	2.7
Fresno Beauty						4.2	5.1
Golden Chasselas	2.6		.64				
Grenache	2.9	2.18	2.34	1.00	1.7	3.2	5.1
Malaga	3.6	2.08	1.68	1.99	1.7	2.0	3.1
Malvoisie		3.16	3.81	1.58		3.6	195.6
Mission	2.2	.31	2.12	2.81		1.5	3.2
Mourastel			1.12				
Muscat		2.57	.33	29.37	3.2	116.3	2.4
Palomino	11.6	1.52	2.65	2.46	5.3	1.3	8.5
Petite Sirah	1.4	1.69					
Ribier	2.2	1.58	1.85	1.34	2.0	1.8	2.9
San Salvador	10.6		.48				
Sultana			1.46	1.32	1.5	1.6	3.4
Thompson	1.7	1.42	2.79	2.33	2.5	1.8	1.9
Tokay	2.2					1.2	.2
Zinfandel	5.3	3.11	2.94		.1	4.0	7.0

Tests were made of the tentative hypothesis that for Thompson, Carignane, and Malaga varieties in 1947 there were no statistically significant differences in dispersion patterns among the three wineries. This hypothesis could be stated alternatively--that, if sugar content for all of the grapes of these three varieties were measured in 1947, there would be no differences in the dispersion patterns of individual load records about the means for the various classifications. The differences in dispersion patterns about the season averages were highly significant for both Thompsons and Carignanes. There appear to be significant differences in the variances of Malaga grapes for Wineries A, B, and C for 1947.29/ In general, for any one of the three seasons, there were significant differences among wineries in the dispersion patterns of individual observations about the varietal average sugar content.

The differences in both means and variances for seven major varieties originating in the Sanger, Dinuba, Fresno, Kingsburg, and Reedley areas and delivered to Winery B over the three seasons 1947-1949 are summarized in Table 5. Patterns of dispersion of a given variety from a single area differ widely over time. With differences among means and variances over time, it would be difficult effectively to predict the impact of specified sugar point minima even on a single

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29/ See Appendix Tables VII and VIII.

variety from a single production area delivered to a single winery. Significant differences in both season average sugar and in patterns of dispersion of the individual readings about the relevant means are found for Muscats, Thompsons, Malagas, and all grapes both between and within seasons. Similarly, there are highly significant differences both within given areas of production over time and between areas of production within a given season.

Thus, it is clear that the commercial records of grapes crushed in the seasons 1947-1949 indicate wide differences in the dispersion of individual items about the season averages. These significant differences apply to the same varieties in the same season with different wineries; to different varieties in the same season at a given winery; to the same variety at given wineries in different years; and to the same variety at the same winery in a given season but with different areas of production.

Two conclusions may be adduced. Even if average sugar content were the same by variety, by receiving winery, by area of origin, and from one season to another, the impact of a given sugar minimum would have widely different effects on the different classifications because, in almost all cases, the dispersion patterns differ significantly. Second, in view of these wide variations, it would be most difficult to predict the effects, in total or in any classification, of applying a given sugar minimum. Even for a given winery in a single season, both the average sugar content and the dispersion patterns differ significantly among the varieties crushed. For given wineries, there are significant differences over time both in sugar content averages and dispersion patterns for given varieties. In the same season, the average sugar content for all grapes crushed differs significantly among receiving wineries. Over time there are significant differences in season average sugar content of given varieties of grapes received by a given winery. In the same season, season average sugar content differs significantly for given varieties received by different wineries. When both wineries and seasons vary, the differences in season average sugar content for given varieties also differ significantly. For grapes of given variety, received at a given winery in a single season, the differences in season average sugar content as a function of different areas or origin are also significant. Finally, the variances or patterns of dispersion about the season average sugar content of all the grapes differ significantly in terms of varieties, receiving wineries, areas of origin, and seasons. In the face of these differences, the impact of limitation through sugar content specification will differ widely among varieties, wineries, areas of origin, and seasons. The quantitative effects of elimination through minimum sugar standards are shown in detail in a subsequent section. Further, there appears to be insufficient stability in season average sugar content and in dispersion patterns to admit ready or precise prediction of either the total limitation of tonnage associated with a given minimum requirement or its distribution among producers of given varieties, in given areas or seasons, and among receiving wineries.

Intraseasonal Changes in Sugar Content

To measure the over-all seasonal limitation of tonnage crushed through minimum sugar levels, season average sugar content and variances alone need be regarded. These data do not fully measure the impact of such control upon operations and equities of growers and vintners. Therefore, the following sections are aimed at two main issues: (1) to describe the intraseasonal changes in sugar by varieties of grapes, by receiving wineries, by areas or origin, and by seasons and (2) to test the significance of differences among the intraseasonal trends of the various classifications.

Linearity of Trends.--Tests were made of the linearity of intraseasonal trends--or the degree to which the average daily rate of change in average sugar content is the same within all parts of the season--for Thompson grapes in the 1947, 1948, and 1949 seasons and for Muscats in 1947 and 1948. Tests to appraise improvement, if any, in description of the trend consequent upon introduction of more complex forms indicated that no simple function will precisely describe the intraseasonal trends for all varieties delivered to any one winery in a given season. However, linear trends generally provided significant fits. While higher order functions relating sugar content to harvest date could be used validly, the linear form alone seemed reasonable for all classifications. Least squares calculations of such functions are relatively simple. A wider range of tests may be applied to linear functions. For these reasons, linear trends are used throughout.

Different Varieties, One Winery, One Season.--Daily average rates of change in sugar content are shown in Table 8 and in Figures 5 to 11 by varieties, seasons, and receiving winery, for Winery A in 1947 and for Wineries B and C in 1947, 1948, and 1949. In all charts, the vertical axis indicates average sugar content per lot or load. The horizontal axis indicates the date of delivery. These trends are fitted by least squares. The trend value for any given day of delivery is an average. Fitting of linear trends is based on the assumption that the average rate of change per day is the same at all parts of the season. Explanation of the trends in Figure 5 will serve as explanation of similar charts for other classifications. The line marked "all varieties" represents average daily rate of change in sugar content of all varieties crushed by Winery A. The number, 1,781, in brackets indicates the number of loads included in the calculations. The line slopes downward. This indicates that there was a systematic pattern of daily average decrease in sugar content as the season progressed. Table 7a indicates that the average daily decrease in average sugar content was .0776 per cent--or that about every thirteen days on the average there was a decrease of one full percentage point in average sugar content for all grapes delivered to Winery A in 1947.30/ The line for all varieties is heavy. This indicates that the trend is statistically significant. Similarly, column 7 of Table 7a indicates that the probability of drawing a sample with this indicated rate of change from basic data in which the true rate of change was zero is very low.31/ Trends are negatively sloped for Missions, Carignanes, Thompsons, Malagas, Tokays, Alicantes, and Palominos. Estimated rates of change for Missions and Alicantes are of a lower order of statistical significance than those shown by heavy lines. Sugar content apparently rose during the season for Petite Sirah, Golden Chasselas, and Ribier varieties at Winery A in 1947, but the latter two are not statistically significant. Each trend line is broken by a small line. This line is so placed as to indicate on the vertical axis the average sugar content for the season as a whole and on the horizontal axis the median date of unloads within the season--or the middle of the crushing season for that variety at Winery A.

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30/ This does not necessarily mean that grapes lost sugar on the vines in 1947. It merely means that average sugar of grapes delivered to the winery decreased as the season advanced. This pattern is common to all wineries and to many varieties and areas of origin in the 1947 season.

31/ The "t" value indicates low likelihood that the calculated negative regression is attributable to sampling variation.

FIGURE 5

Intraseasonal Trends in Daily Average Sugar Content, by Varieties, Winery A, 1947

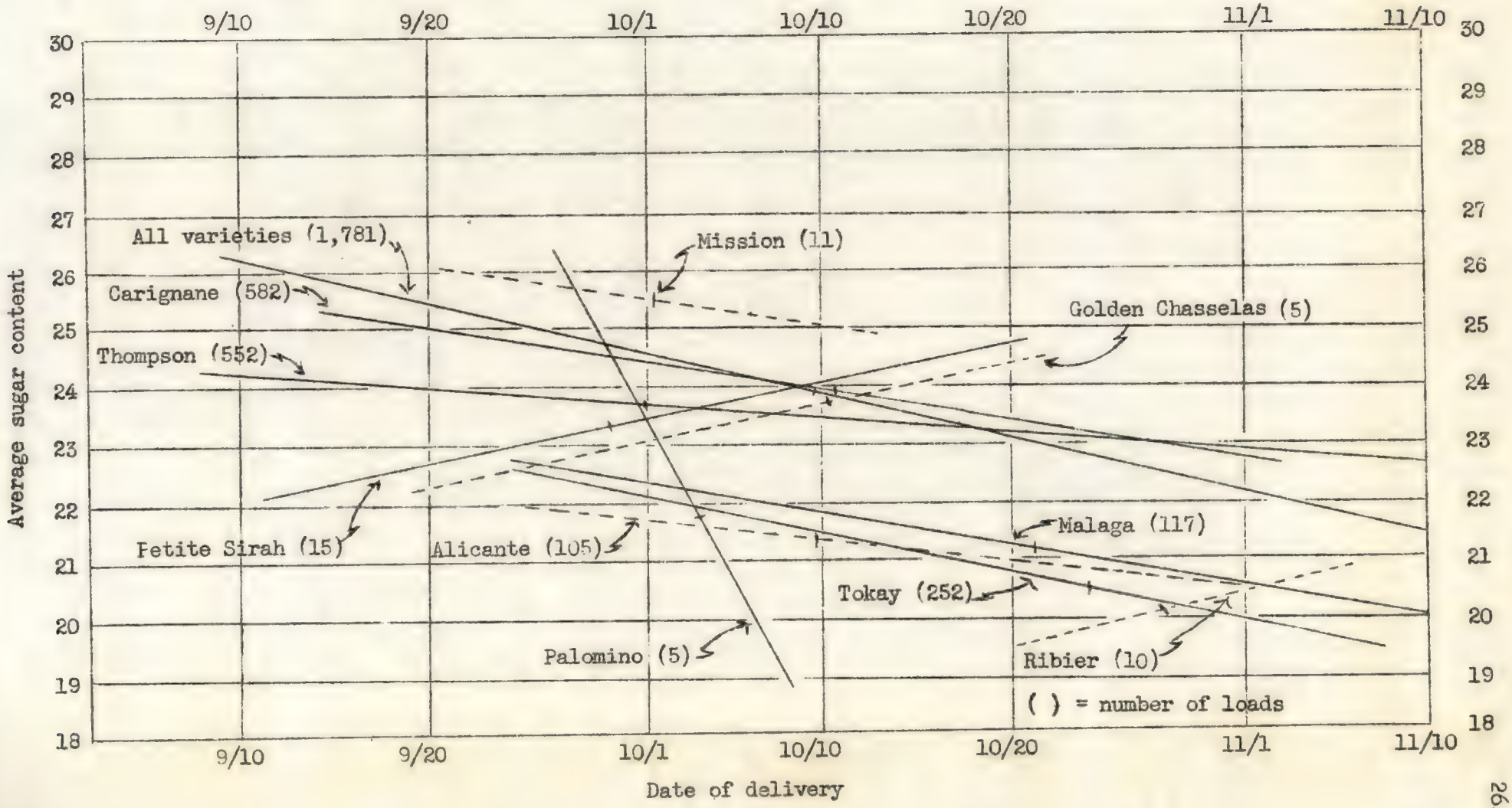

TABLE 7

Estimated Daily Average Rate of Change in Sugar Content,
95 Per Cent Confidence Intervals and Levels of Significance
Winery A, 1947 and Wineries B and C, 1947-1949

Variety	Number of loads	Range of sampling dates	Regression coefficient b_{yx}	Limits[a/]	"t" value	Level of significance (per cent)
1	2	3	4	5	6	7
7a--Winery A--1947						
Alicante	105	Sept. 23-Nov. 1	-.0408	.0486	1.6653	80
Carignane	582	Sept. 15-Nov. 3	-.0580	.0130	8.7879	99
Golden Chasselas	5	Sept. 18-Oct. 22	.0673	.1645	1.0516	60
Grenache	76	Sept. 16-Oct. 24	-.0006	.0281	.0426	b/
Malaga	117	Sept. 24-Nov. 10	-.0610	.0279	4.3262	99
Mission	11	Sept. 22-Oct. 14	-.0471	.1226	.8456	50
Palomino	5	Sept. 25-Oct. 17	-.6285	.3211	5.0320	99
Petite Sirah	15	Sept. 11-Oct. 21	.0684	.0426	3.4200	99
Ribier	10	Oct. 20-Nov. 7	.0729	.1698	.9567	60
San Salvador	7	Oct. 1-Oct. 7	-.2499	1.5912	.3714	b/
Thompson	552	Sept. 8-Nov. 10	-.0293	.0083	6.9762	99
Tokay	252	Sept. 23-Nov. 8	-.0713	.0277	5.0567	99
Zinfandel	44	Sept. 15-Oct. 27	-.0133	.0753	.3556	b/
All varieties	1,781	Sept. 8-Nov. 10	-.0776	.0065	23.5152	99
7b--Winery B--1947						
Alicante	318	Sept. 7-Nov. 10	.0518	.0112	9.9615	99
Carignane	141	Sept. 5-Nov. 7	-.0730	.0198	7.3000	99
Emperor	22	Sept. 20-Nov. 10	-.0003	.0718	.0009	c/
Feher Szago	71	Sept. 11-Oct. 20	-.0563	.0662	1.6953	90
Grenache	18	Sept. 7-Nov. 6	.0187	.0515	.7633	50
Malaga	261	Sept. 5-Nov. 10	-.0227	.0106	4.2037	99
Malvoisie	56	Sept. 9-Oct. 7	-.0110	.0566	.3887	c/
Mission	19	Oct. 4-Nov. 7	.0144	.0326	.8324	50
Muscat	781	Sept. 11-Nov. 10	-.0321	.0078	8.0250	99
Palomino	102	Sept. 7-Oct. 7	-.0977	.0280	6.9291	99
Petite Sirah	13	Sept. 5-Sept. 20	.0537	.1646	.7047	50
Ribier	34	Sept. 14-Nov. 7	.0288	.0203	2.8800	99
Sultana	111	Sept. 4-Nov. 1	-.0220	.0198	2.2000	95
Thompson	1,013	Aug. 14-Oct. 21	.0165	.0086	3.7500	99
Zinfandel	44	Sept. 2-Oct. 27	-.0716	.0451	3.1964	99
All varieties	3,004	Aug. 14-Nov. 10	-.0079	.0047	3.2917	99
7c--Winery B--1948						
Alicante	150	Sept. 18-Nov. 24	.0900	.0198	9.0000	99
Carignane	218	Sept. 16-Nov. 22	.0412	.0197	4.1200	99
Emperor	41	Oct. 28-Nov. 26	.1280	.6314	.4097	b/
Feher Szago	17	Sept. 16-Oct. 22	-.1378	.4203	.6918	50
Golden Chasselas	7	Sept. 27-Oct. 2	-.0126	.0785	.3795	b/
Grenache	43	Sept. 27-Nov. 17	.0844	.0348	4.6474	99
Malaga	350	Aug. 30-Nov. 26	.0326	.0077	8.3590	99

(Continued on next page.)

Table 7 continued.

Variety	Number of loads	Range of sampling dates	Regression coefficient b_{yx}	Limits[a/]	"t" value	Level of significance (per cent)
1	2	3	4	5	6	7
7c--Winery B--1948 (continued)						
Malvoisie	69	Oct. 2-Nov. 19	.1307	.0345	7.5549	99
Mourastel	11	Oct. 4-Oct. 13	-.2342	.1409	3.6594	99
Mission	21	Oct. 1-Nov. 17	-.0132	.6026	.0456	b/
Muscat	985	Aug. 10-Nov. 26	.0167	.0020	16.7000	99
Palomino	89	Sept. 8-Nov. 3	.0257	.0280	1.8227	50
Ribier	60	Sept. 10-Nov. 23	.0260	.0200	2.6000	95
San Salvador	7	Oct. 4-Oct. 6	-.4247	.8580	1.1706	70
Sultana	100	Sept. 17-Nov. 10	-.0085	.0198	.8500	50
Thompson	1,463	July 17-Nov. 22	.0564	.0055	20.1429	99
Zinfandel	33	Sept. 15-Nov. 4	.0399	.0351	2.3064	95
All varieties	3,664	July 17-Nov. 26	.0386	.0033	22.7059	99
7d--Winery B--1949						
Alicante	154	Sept. 28-Oct. 31	.1390	.0395	6.9500	99
Carignane	130	Sept. 28-Nov. 4	.0779	.0443	3.4777	99
Emperor	363	Sept. 28-Nov. 6	.0525	.0197	5.2500	99
Feher Szago	10	Oct. 1-Nov. 4	.0944	.1591	1.3221	80
Grenache	25	Oct. 4-Oct. 26	.0539	.0618	1.7967	90
Malaga	230	Sept. 28-Nov. 6	.0579	.0197	5.7900	99
Malvoisie	19	Sept. 28-Oct. 26	.0675	.0724	1.9509	90
Mission	28	Oct. 3-Nov. 3	.1778	.0543	6.7094	99
Mourastel	7	Sept. 30-Oct. 5	-.5366	.2767	4.5863	99
Muscat	562	Sept. 29-Nov. 5	.4757	.0481	19.4163	99
Palomino	46	Sept. 29-Oct. 17	.0018	.1273	.0285	c/
Ribier	71	Sept. 28-Nov. 5	.0388	.0199	3.8800	99
Sultana	95	Sept. 30-Oct. 28	.0234	.0280	1.6596	90
Thompson	106	Sept. 28-Nov. 2	.0515	.0397	2.5750	95
All varieties	1,846	Sept. 28-Nov. 6	.0590	.0196	5.9000	99
7e--Winery C--1947						
Zinfandel	6	Oct. 20-Oct. 22	.0012	.5611	.0052	c/
Cornichon	8	Oct. 24-Nov. 10	-.1900	.1598	2.7417	95
Grenache	11	Oct. 23-Nov. 3	.1034	.2320	.9810	60
Palomino	18	Sept. 27-Nov. 10	-.0577	.0813	1.4910	80
Carignane	42	Sept. 29-Nov. 6	-.0732	.0536	2.7623	99
Feher Szago	34	Sept. 25-Nov. 13	-.0289	.0455	1.2902	70
Alicante	29	Sept. 27-Nov. 20	-.0582	.0646	1.8418	90
Ribier	46	Oct. 16-Nov. 25	.0003	.0348	.0173	c/
Thompson	136	Sept. 26-Nov. 21	.0425	.0198	4.2500	99
Emperor	433	Oct. 7-Nov. 25	-.0129	.0112	2.2632	95
Sultana	142	Sept. 30-Nov. 19	.0958	.0130	14.5152	99
Muscat	538	Sept. 25-Nov. 17	-.0793	.0197	7.9300	99
Malaga	934	Sept. 29-Nov. 21	-.0130	.0098	2.6000	99
All varieties	2,377	Sept. 25-Nov. 25	-.0957	.0077	24.5385	99

(Continued on next page.)

Valverde	69	Oct.	2-Nov.	19	.1307	.0865	7.7
Montarrel	11	Oct.	4-Oct.	13	-.1312	.1406	7.1
Estelon	21	Oct.	1-Nov.	17	-.0132	.0756	
Tuscat	585	Aug.	10-Nov.	26	.0107	.0259	14.7
Falconino	89	Sept.	8-Nov.	3	.0287	.0886	1.2
Trollet	60	Sept.	10-Nov.	22	.0200	.0000	3.2
	7	Oct.	4-Oct.		-.1217	.0000	4.7
	100	Sept.	7-Nov.		.0897	.0000	.1000
	1,210	Oct.	7-Nov.		.0564	.0000	10.1
Chromial	72	Oct.	15-Nov.		.0353	.0000	2.2
	100	Oct.	17-Nov.		.0000	.0000	
Alderete	154	Sept.	2-Oct.	10	.0465	.0000	4.2
Carrigano	130	Sept.	28-Nov.	4	.1217	.0000	3.7
	363	Sept.	28-Nov.		.0000	.0000	
Fuller Sango	10	Oct.			.0000	.0000	5.2
	50	Oct.			.0000	.0000	1.7
Malaga	100	Sept.	28-Nov.	4	.0177	.0000	1.7
	50	Sept.		3	.0121	.0000	1.2
Lesson	50	Oct.	7-Nov.		.0000	.0000	1.2
	50	Sept.			.0000	.0000	1.2
Tuscat	100	Sept.		10	.0000	.0000	10.2
Falconino	50	Sept.			.0000	.0000	1.2
Lamont	75	Sept.	20-Oct.	24	.0000	.0000	3.2
Thompson	106	Sept.	28-Nov.	2	.0000	.0000	.5
	100	Sept.		5	.0000	.0000	5.2
	4	Sept.		10	.0000	.0000	.1
	50	Sept.		10	.0000	.0000	1.2
	100	Sept.		10	.0000	.0000	2

Variety	Number of loads	Range of sampling dates	Regression coefficient b_{yx}	Limits[a]	"t" value	Level of significance (per cent)
1	2	3	4	5	6	7
7f--Winery C--1948						
Alicante	22	Oct. 7-Nov. 18	.0771	.0508	3.1469	99
Black Monukka	29	Oct. 5-Nov. 19	.0489	.0614	1.6300	80
Carignane	177	Oct. 1-Nov. 24	.0339	.0197	3.3900	99
Emperor	29	Oct. 20-Nov. 24	.0622	.0579	2.1979	95
Feher Szago	34	Sept. 23-Nov. 22	.0159	.0406	.7950	50
Fresno Beauty	9	Oct. 27-Nov. 17	.2204	.0391	12.7399	99
Grenache	93	Oct. 2-Nov. 20	.0894	.0199	8.9400	99
Malaga	434	Sept. 21-Nov. 24	.0438	.0090	9.5217	99
Malvoisie	20	Oct. 4-Nov. 3	.1364	.0753	3.7784	99
Mission	21	Oct. 7-Nov. 20	.0418	.0510	1.7061	80
Muscat	1,382	Oct. 1-Nov. 24	.0730	.0100	141.2353	99
Palomino	46	Oct. 2-Nov. 13	.0012	.0284	.0851	[c]
Ribier	44	Sept. 21-Nov. 23	.0378	.0284	2.6809	95
Sultana	106	Sept. 17-Nov. 16	.0424	.0113	7.4386	99
Thompson	1,044	Sept. 17-Nov. 13	.0243	.0059	8.1000	99
Tokay	186	Oct. 28-Nov. 17	.0746	.0341	4.3121	99
Zinfandel	77	Oct. 7-Nov. 17	.0081	.0597	.2700	[c]
All varieties	3,753	Sept. 17-Nov. 24	.2015	.0098	40.3000	99
7g--Winery C--1949						
Alicante	111	Sept. 29-Nov. 7	.0766	.0486	3.1265	99
Black Monukka	11	Sept. 29-Nov. 2	.0616	.1145	1.1846	70
Carignane	335	Sept. 29-Nov. 11	.2164	.0340	12.5087	99
Cornichon	5	Oct. 10-Oct. 29	.1340	.1476	2.3345	90
Emperor	326	Oct. 5-Nov. 25	.0197	.0197	1.9700	95
Feher Szago	106	Sept. 26-Nov. 23	.0539	.0343	3.1156	99
Fresno Beauty	5	Oct. 25-Oct. 28	1.3646	2.0463	1.7145	[c]
Grenache	178	Sept. 28-Nov. 8	.1791	.0278	12.7021	99
Malaga	752	Sept. 27-Nov. 26	.0329	.0112	5.7719	99
Malvoisie	70	Sept. 29-Oct. 22	.0080	.5350	.0298	[c]
Mission	46	Sept. 30-Nov. 3	.1002	.0570	3.5406	99
Muscat	910	Sept. 27-Nov. 22	.0659	.0126	10.2969	99
Palomino	81	Sept. 29-Nov. 26	.0024	.0398	.1200	[c]
Ribier	64	Oct. 5-Nov. 9	.1380	.0448	6.1607	99
Sultana	154	Sept. 26-Nov. 9	.1160	.0198	11.6000	99
Thompson	451	Sept. 26-Nov. 18	.0303	.0197	3.0300	99
Tokay	7	Oct. 20-Oct. 25	.0583	.2493	.5531	[c]
Zinfandel	20	Sept. 29-Nov. 4	.0506	.1368	.7713	50
All varieties	3,632	Sept. 26-Nov. 26	.0174	.0088	3.8667	99

[a] The upper limit is determined by adding the entry in this column to the respective slope. The lower limit is determined by subtracting the entry from the respective slope.

[b] Not significant.

[c] Less than 50 per cent.

[illegible]							
[illegible]							
[illegible]							

The data shown in Figure 5 are further developed in Table 7a. The regression coefficients, column 4, show the average change in sugar per day over the season as computed by least squares calculations. The entries in column 4 give the 95 per cent confidence intervals about the regression coefficients. Addition of the entry to the coefficient or slope gives the upper limit; subtraction of this entry from the regression coefficient sets the lower limit. The confidence interval is interpreted as indicated before. The entries in column 6 and column 7 indicate the relative reliability of the estimated regression coefficients or average daily changes in sugar content. More varieties are included in Table 7a than are shown in Figure 5. Both the chart and the table indicate that average sugar content for many varieties decreased as the season of 1947 proceeded. In general, where the rate of daily average decrease in sugar was high, the statistical significance of the calculated average rate of decrease was also high. Average daily decrease in sugar for Alicante, Carignane, Malaga, Mission, Palomino, and Tokay grapes exceeded .04 per cent per day. The average daily rate of decrease in Thompsons was approximately .03 per cent. Petite Sirah grapes alone showed increases which were highly significant statistically.

The 1947 experience of Winery B is summarized in Figure 6 and in Table 7b. For all varieties taken together, there was practically no change in daily average sugar readings during the season. The level and slope of consolidated trends may differ because of the differences in the series which make up the aggregates. Yet, it is the consolidated trend--regardless of its determinants--which determine the total impact of the program. The slight decrease of .0079 per cent is statistically significant, but it represents a rate of fall of only about one-tenth that shown in the data for Winery A in 1947. The impact of sugar control upon Winery A would have been much different from its effects upon Winery B in 1947. Carignane, Feher Szago, and Zinfandel all decreased more than .05 per cent per day--or a full per cent of sugar content in less than twenty days on the average. Muscats decreased more than .03 per cent daily. These decreases were offset by increases in sugar in Alicantes and Petite Sirahs in excess of .05 per cent daily and of lesser increases in Grenache, Ribier, and Thompson grapes. Thus, the over-all pattern of decreasing sugar is the same as in Winery A, but there are significant differences with respect to the trends of the several varieties. Percentages eliminated by minimum sugar requirements would have differed between the two wineries in 1947, both with respect to total crush and to crush of the several varieties.

The great difference in intraseasonal sugar trends of grapes between 1947 and 1948 is indicated for Winery B in Table 7c and in Figure 7. For all varieties taken together, there was an average daily gain in sugar of .0386 per cent. The rate of gain was highly significant statistically. On the average and for all varieties, average sugar content of grapes crushed increased a full percentage point every twenty-six days. Only a few varieties showed decreases and, for most of these, the number of observations was small.32/ Alicante, Grenache, and Malvoisie gained more than .08 per cent daily. Carignane, Malaga, Thompson, and Zinfandel gained more than .03 per cent daily. Other major varieties gained sugar at daily rates ranging from .01 to .03 per cent. This pattern prevailed generally for all three wineries.

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32/ The negative rate of change was statistically significant for Mourastels only.

The data shown in Figure 5 are further developed in Table 7a. The regression coefficients, column 1, show the average change in sugar per day over the season as computed by least squares calculations. The entries in column 2 give the probability that the coefficient or slope gives the upper limit; subtraction of this probability from the regression coefficient gives the lower limit. The column 3 entries are interpreted as in Table 6, above. The entries in column 4 and column 5 indicate the relative reliability of the estimated regression coefficients or average daily changes in sugar content. More variables are included in Table 7a than are shown in Figure 5. Both the chart and the table indicate that average sugar content for many varieties decreased as the season of 1947 progressed. In general, where the rate of daily average decrease in sugar was high, the statistical significance of the calculated average rate of decrease was also high. Average daily decrease in sugar for Alicante, Queen Anne, Portia, Thompson, and Tokay grapes exceeded .01 per cent per day. The average daily rate of decrease in Tokay grapes was approximately .03 per cent. Portia, Queen Anne also showed increases which were highly significant statistically.

The 1947 experience of Variety B is summarized in Figure 6 and in Table 7b. For all varieties taken together, there was practically no change in daily average sugar readings during the season. The level and scope of consolidated hundredweight data may differ because of the difference in the acreage which makes up the aggregates. Very little consolidation trend--regardless of its determinants--which is found in the total impact of the process. The slight decrease of .02% per cent is statistically significant, but it represents a rate of only about one-fifth of one per cent per day--or a full per cent of sugar content in less than twenty days.

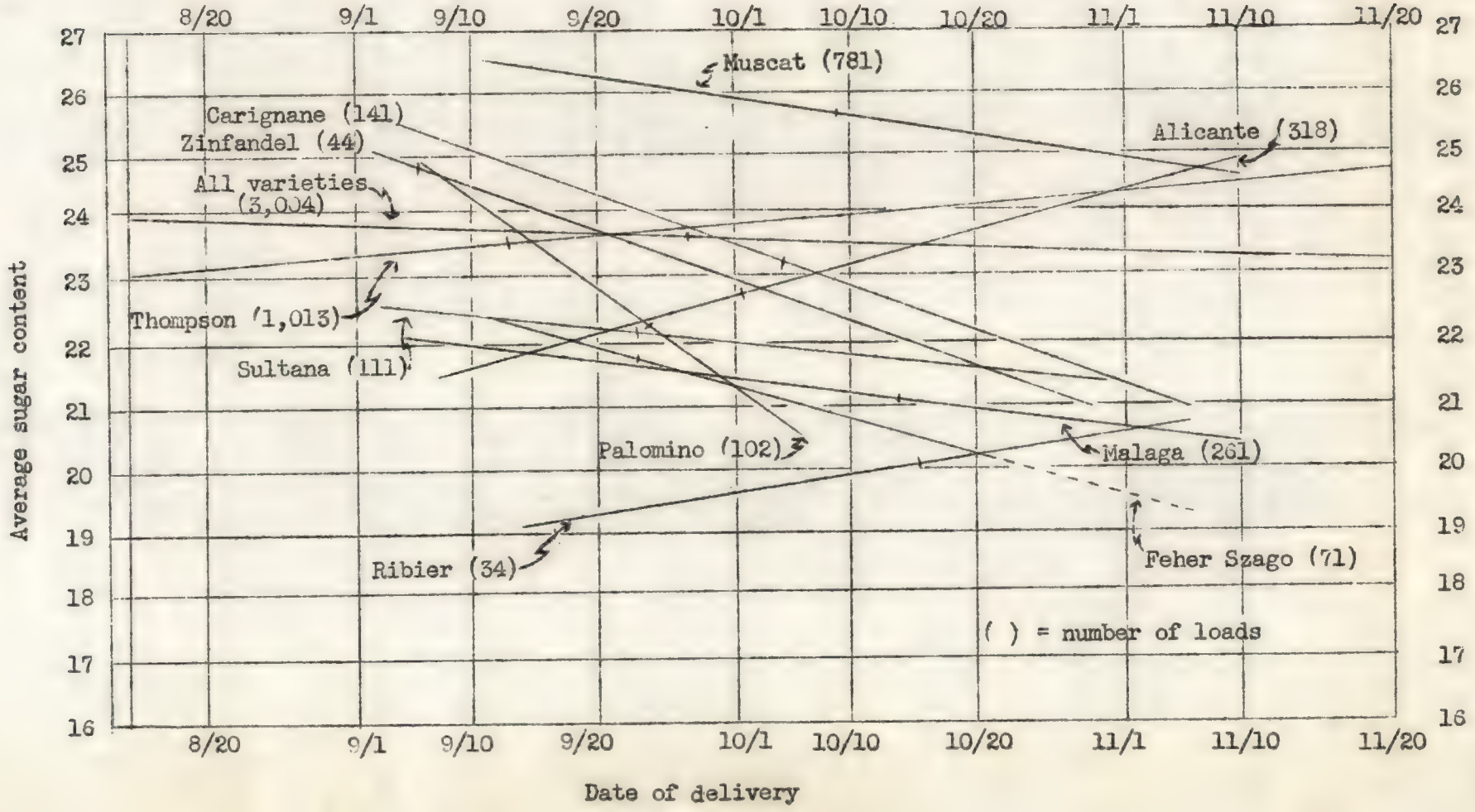
More efficient harvesting practices are indicated for increasing the daily rate of sugar increase in Alicantes and Portia grapes by .05 per cent daily and Tokay increases in Cornichon, Malaga, and Thompson grapes by .03 per cent daily. Differences between the two varieties in 1947 both with respect to total crush and to crush of individual varieties.

All varieties, average hours content of grapes crushed increased a fairly regular and sustained gained more than .02 per cent daily. Carignane, Malaga, Thompson, generally for all three varieties.

[illegible] The negative rate of change was statistically significant for Thompson

FIGURE 6

Intraseasonal Trends in Daily Average Sugar Content, by Varieties, Winery B, 1947



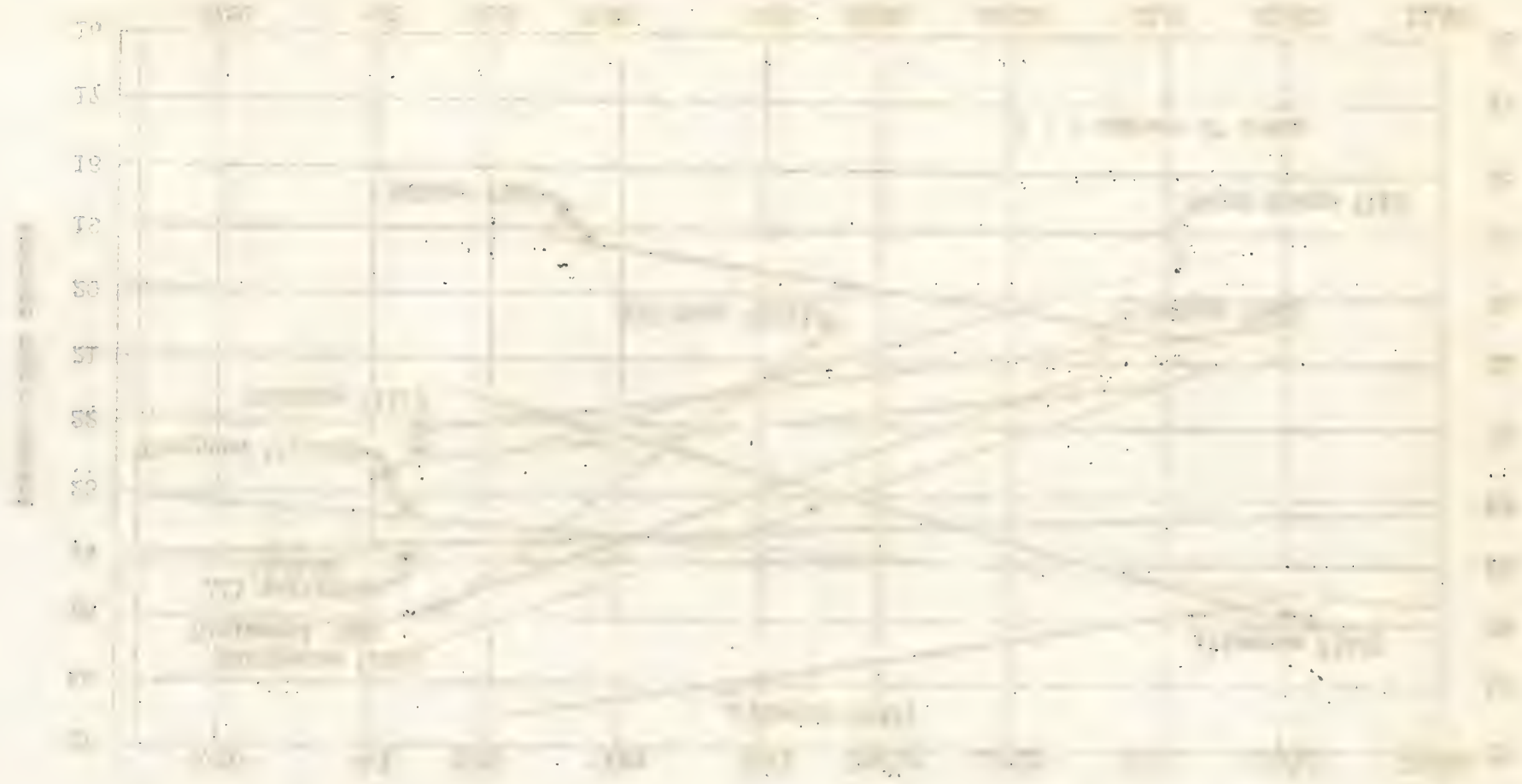
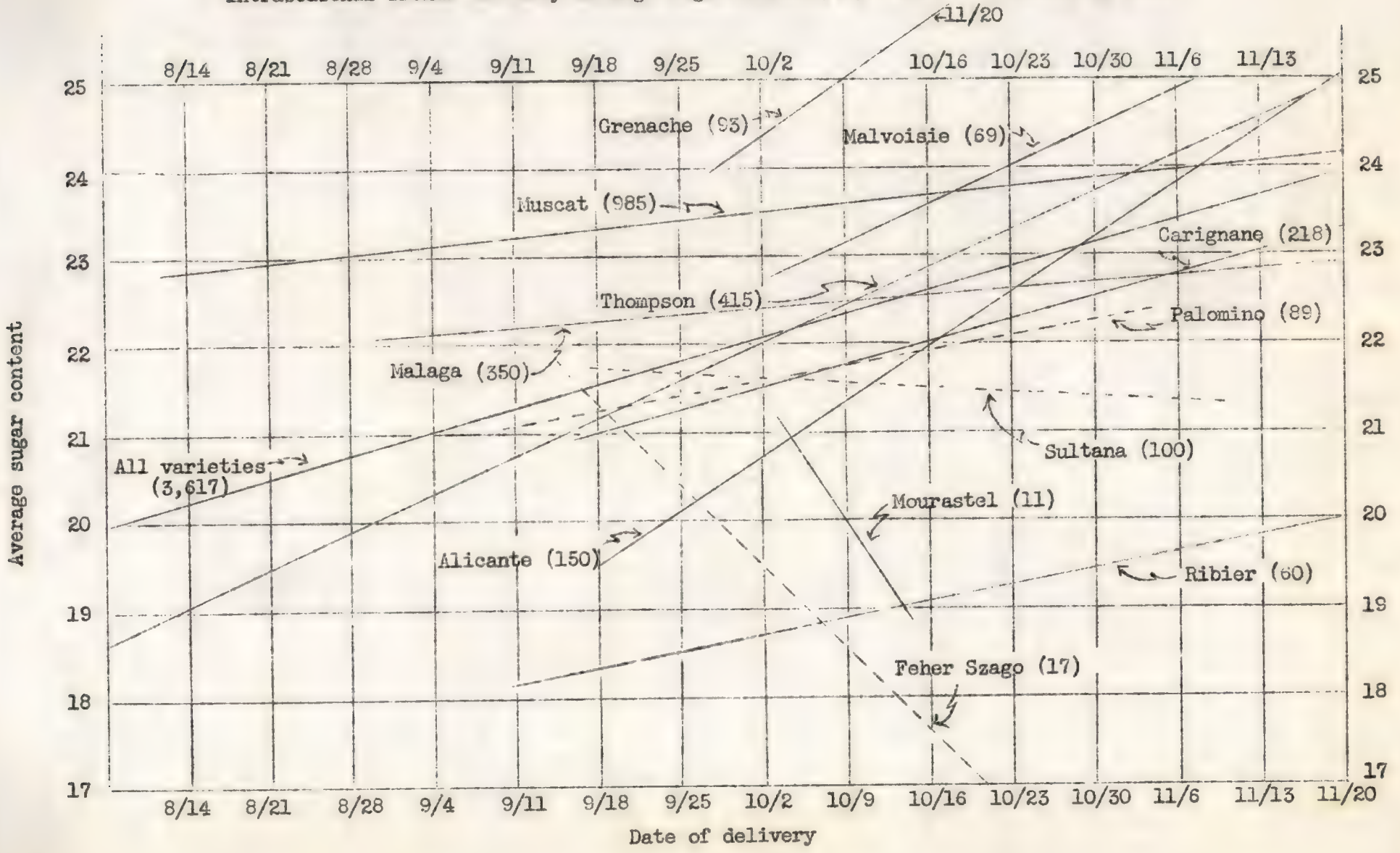
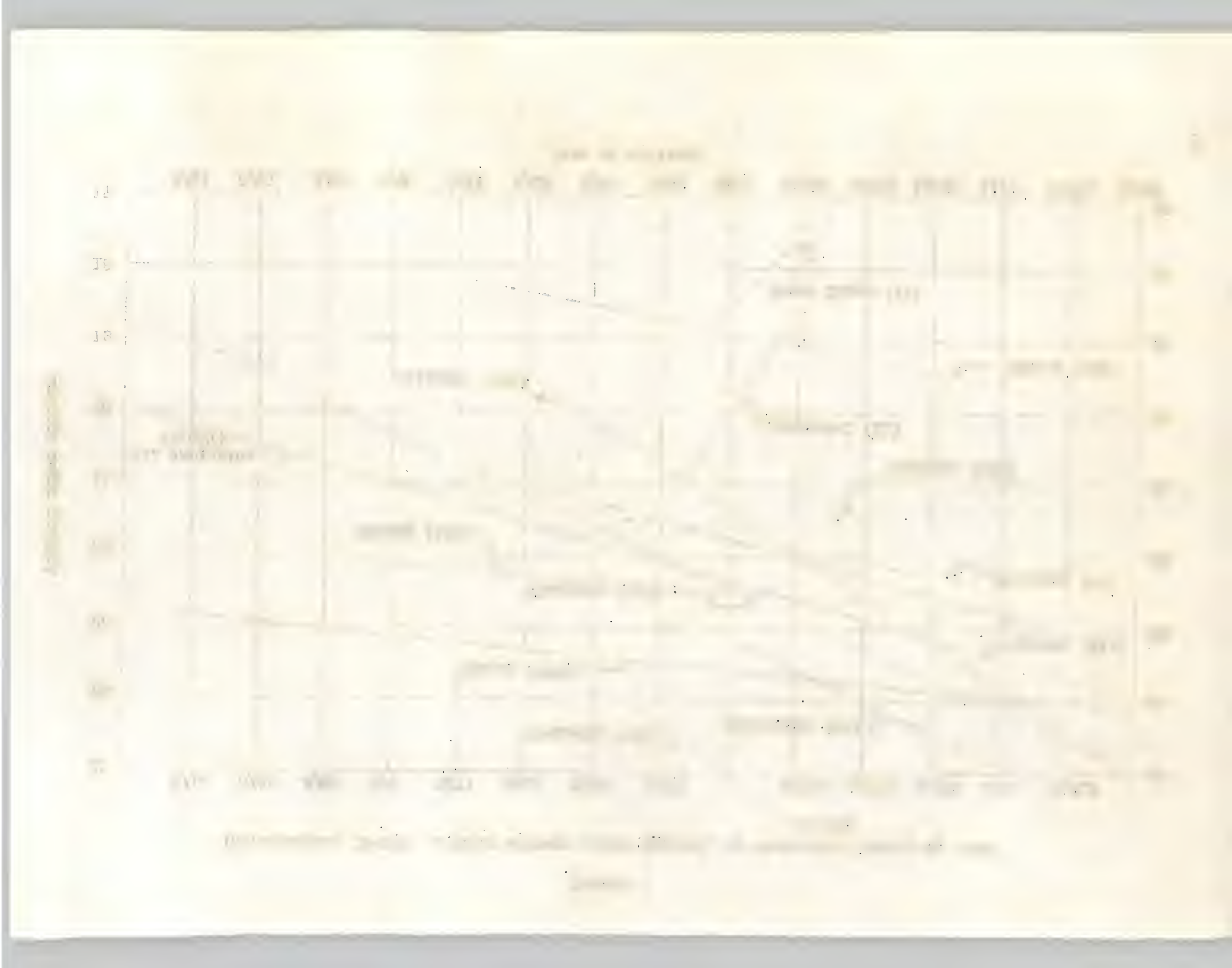


FIGURE 7

Intraseasonal Trends in Daily Average Sugar Content, by Varieties, Winery B, 1948





Major attributes of the 1949 season as represented by the crush of Winery B are summarized in Figure 8 and in Table 7d. The season was shorter than in either 1947 or 1948. The crop was lighter. The normally expected increase in sugar within the season occurred as in 1948. However, the average daily rise in sugar was .059 per cent as compared to .0386 per cent for the same winery in 1948. On the average and for all varieties, there was a gain of a full percentage point in sugar content every seventeen days. Muscat grapes, which decreased in sugar during the 1947 season and gained only slightly in 1948, increased in sugar at Winery B during the 1949 season at the rate of .4757 per cent per day. Alicantes and Missions gained .139 and .1778 per cent, respectively. Gains ranging from .05 to .10 per cent per day were recorded for Carignane, Emperor, Feher Szago, Malaga, Grenache, Malvoisie, and Thompson grapes. Only one variety--Mourastel--with few observations showed significant decreases in daily average sugar during the season. These data indicate that there are major differences in the level and intraseasonal trends of grape sugar among varieties received in one season at the same winery. The degree and significance of the differences in daily rates of intraseasonal change in sugar are appraised in subsequent sections. There are also estimates of the differences in percentage of tonnage eliminated by various minimum sugar content requirements.

Intraseasonal trends for grapes received by Winery C are shown in Figures 9 to 11 and Tables 7e to 7g for the years, 1947-1949. For all varieties taken together, the average daily rate of decrease in average sugar content for Winery C in the 1947 season was .0957 per cent. This means a decrease of a full percentage point in sugar content about every 10.5 days. This regression of sugar content on time is highly significant statistically. The rate of decrease exceeded the average daily decrease in sugar for all varieties received at both Winery A and Winery B in 1947. However, the general pattern was much the same. Muscat grapes delivered at Winery C in 1947 decreased in sugar readings by an average rate of .0793 per cent per day. Carignanes decreased at the rate of .0732 per cent per day. Only Thompson and Sultana grapes recorded gains of sugar exceeding .04 per cent per day at acceptable levels of statistical significance. Increases in recorded sugar readings were reported for Zinfandel, Grenache, and Ribier grapes. However, these estimated rates of increase in sugar were low and were not statistically significant.

The 1948 data for Winery C are recorded in Figure 10 and in Table 7b. For all varieties taken together, recorded sugar content of grapes delivered to Winery C in 1948 gained .2015 per cent per day on the average over the season. This regression coefficient is highly significant statistically. It represents on the average an increase of a full percentage point in recorded average daily sugar content in less than five days. This compares to a gain in 1948 of only .0386 per cent per day on the average for Winery B. Muscat grapes, which had decreased in recorded sugar in the 1947 season, showed increases of .07203 per cent per day on the average. Thompson grapes increased on the average only .0243 per cent per day. As contrasted with the data for 1947, no variety recorded a decrease in average sugar content as the season proceeded. Several minor varieties showed very high rates of increase. Other varieties showed positive rates of change in daily sugar content, but the recorded changes were not statistically significant.

The recorded daily changes in average sugar content in the 1949 season for grapes delivered to Winery C are shown in Figure 11 and in Table 7g. For all varieties taken together, grapes crushed at Winery C in 1949 gained on the average .0174 per cent per day. This daily average rate of increase is significant at the 99 per cent level of probability. This means that the reported rate of

are summarized in Figure 8 and in Table 7a. The season was shorter than in either 1917 or 1918. The crop was lighter. The normally expected increase in sugar within the season occurred as in 1918. However, the average daily rise in sugar was .09% per cent as compared to .038% per cent for the same variety in 1918. On the average and for all varieties, there was a gain of a full percentage point in sugar content every seventeen days. Nearest grapes, which decreased in sugar during the 1917 season and gained only slightly in 1918, increased in sugar at Winery B during the 1919 season at the rate of .172% per cent per day. Nineteen and Missions gained .139 and .1178 per cent, respectively. Grapes ranging from .05% to .2% per cent per day were recorded for Zinfandel, Carignane, Petite Sauvo, Ribiera, Grenache, Alicante, and Thompson grapes. Only one variety--Mourvedre--with few observations showed significant decreases in daily average sugar during the season. These data indicate that there are major differences in the level and intraseasonal trends of grape sugar among varieties received in one season at the same winery. The degree and significance of the differences in daily rates of intraseasonal change in sugar are reflected in subsequent sections. There are also estimates of the differences in percentage of tonnage eliminated by various minimum sugar content requirements.

Intraseasonal trends for grapes received by Winery C are shown in Figures 9 to 12 and Tables 7- to 7g for the years, 1916-1919. For all varieties taken together, the average daily rate of decrease in average sugar content for Winery C in the 1917 season was .05% per cent. This means a decrease of a full percentage point in sugar content about every 19.5 days. The temperature of sugar content on time is highly significant statistically; the ratio at both Winery A and Winery B in 1917. However, the general pattern was the same. Nearest grapes delivered at Winery C in 1917 decreased in sugar readings by an average rate of .0743 per cent per day. Carignane, Zinfandel and rate of .0736 per cent per day. Only Thompson and Sultana grapes recorded gains of sugar exceeding .01% per cent per day at acceptable levels of statistical significance. Increases in Grenache, and Petite Sirah per day. However, the estimated rates of increase in sugar were low and were not statistically significant.

The 1918 data for Winery C are recorded in Figure 10 and in Table 7b. For all varieties taken together, recorded sugar content of grapes delivered to Winery C in 1918 gained .043% per cent per day on the average over the season. This regression coefficient is highly significant statistically. It represents an increase of a full percentage point in recorded average daily sugar content in less than five days. This compares to a gain in 1917 of only .036% per cent per day on the average for Winery C. Nearest grapes, which had decreased in recorded sugar in the 1917 season, showed increases of .07% per cent per day on the average. Thompson grapes increased on the average only .04% per cent per day. As contrasted with the data for 1917, no variety recorded a decrease in average sugar content as the season progressed. Several minor varieties showed very high rates of increase. Other varieties showed positive rates of change in daily sugar content, but the recorded changes were not statistically significant.

The recorded daily changes in average sugar contents in the 1919 season for grapes delivered to Winery C are shown in Figure 11 and in Table 7c. For all varieties taken together, grapes crushed at Winery C in 1919 gained on the average .11% per cent per day. This daily average rate of increase is significant at the 1% per cent level of probability. This means that the recorded rate of

FIGURE 8

Intraseasonal Trends in Daily Average Sugar Content, by Varieties, Winery B, 1949

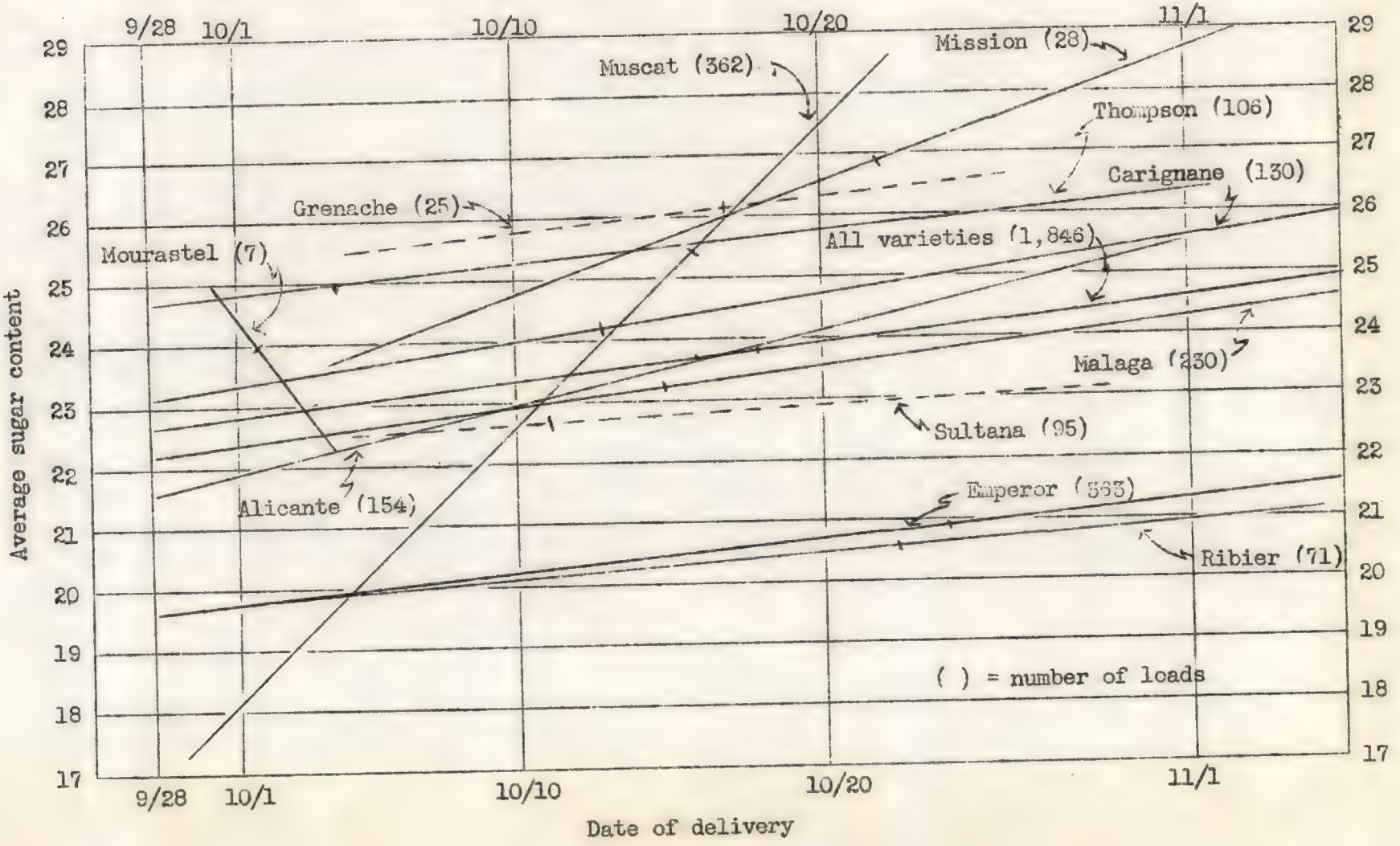
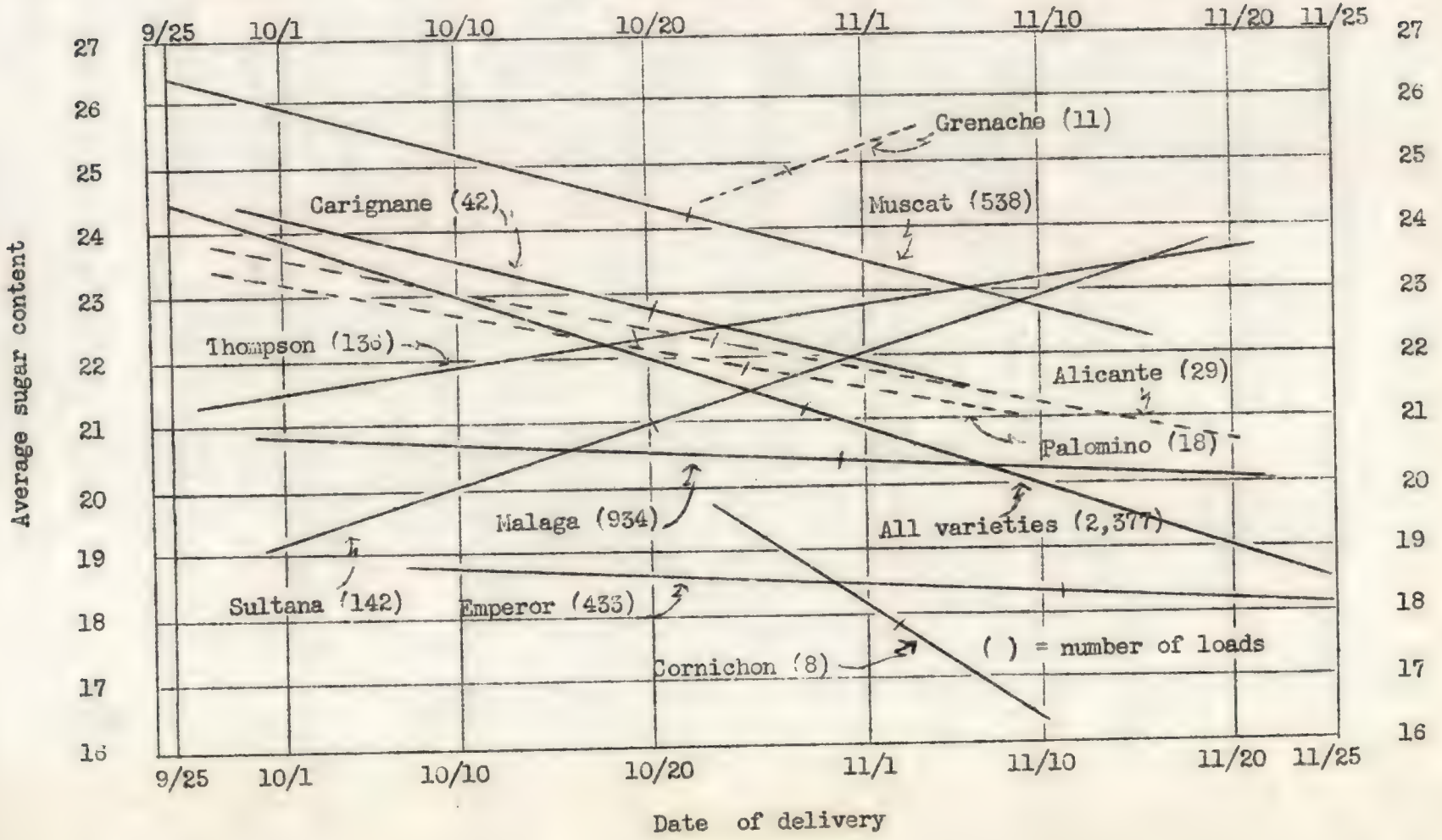


FIGURE 9

Intraseasonal Trends in Daily Average Sugar Content, by Varieties, Winery C, 1947



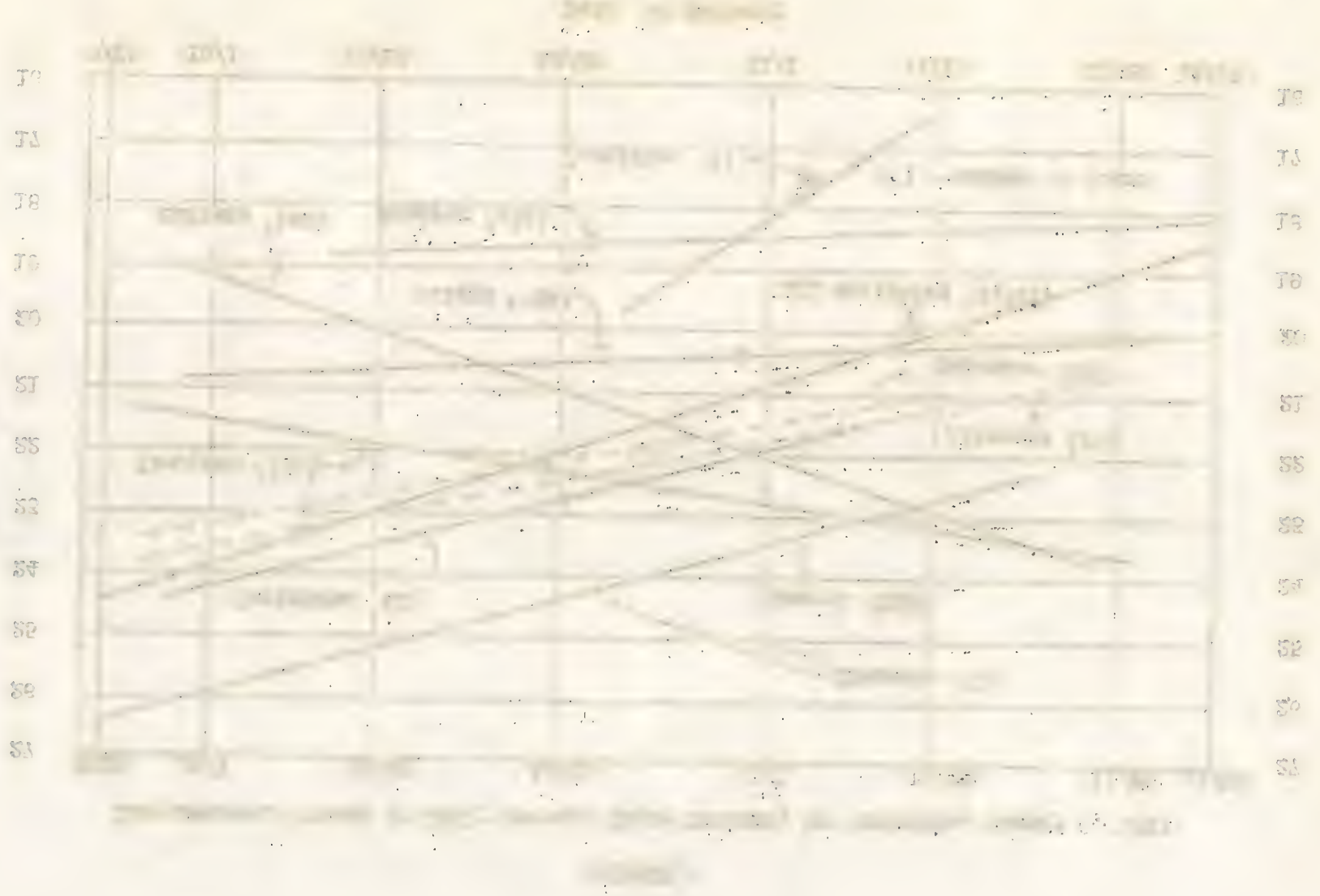


FIGURE 10

Intraseasonal Trends in Daily Average Sugar Content, by Varieties, Winery C, 1948

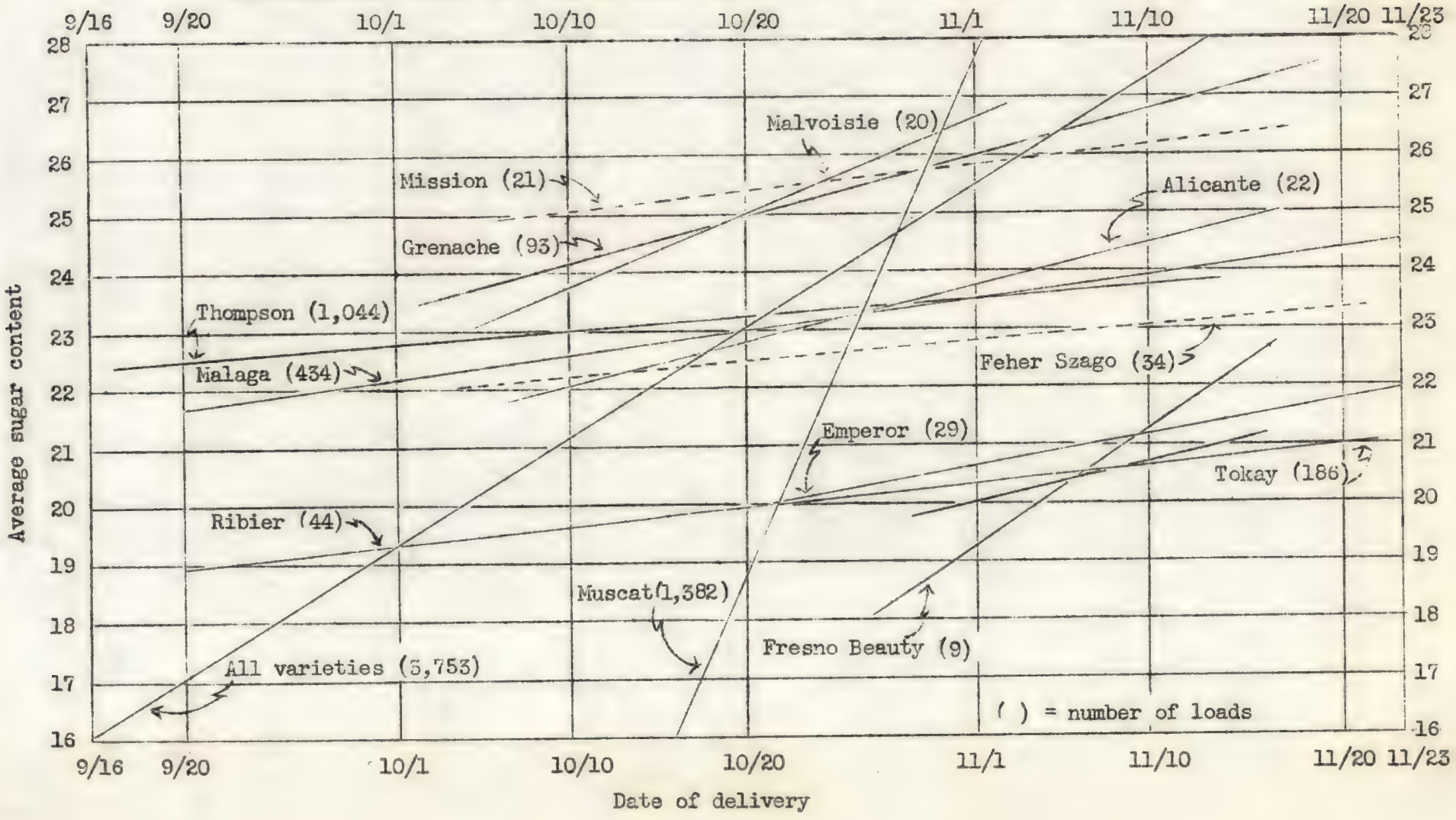
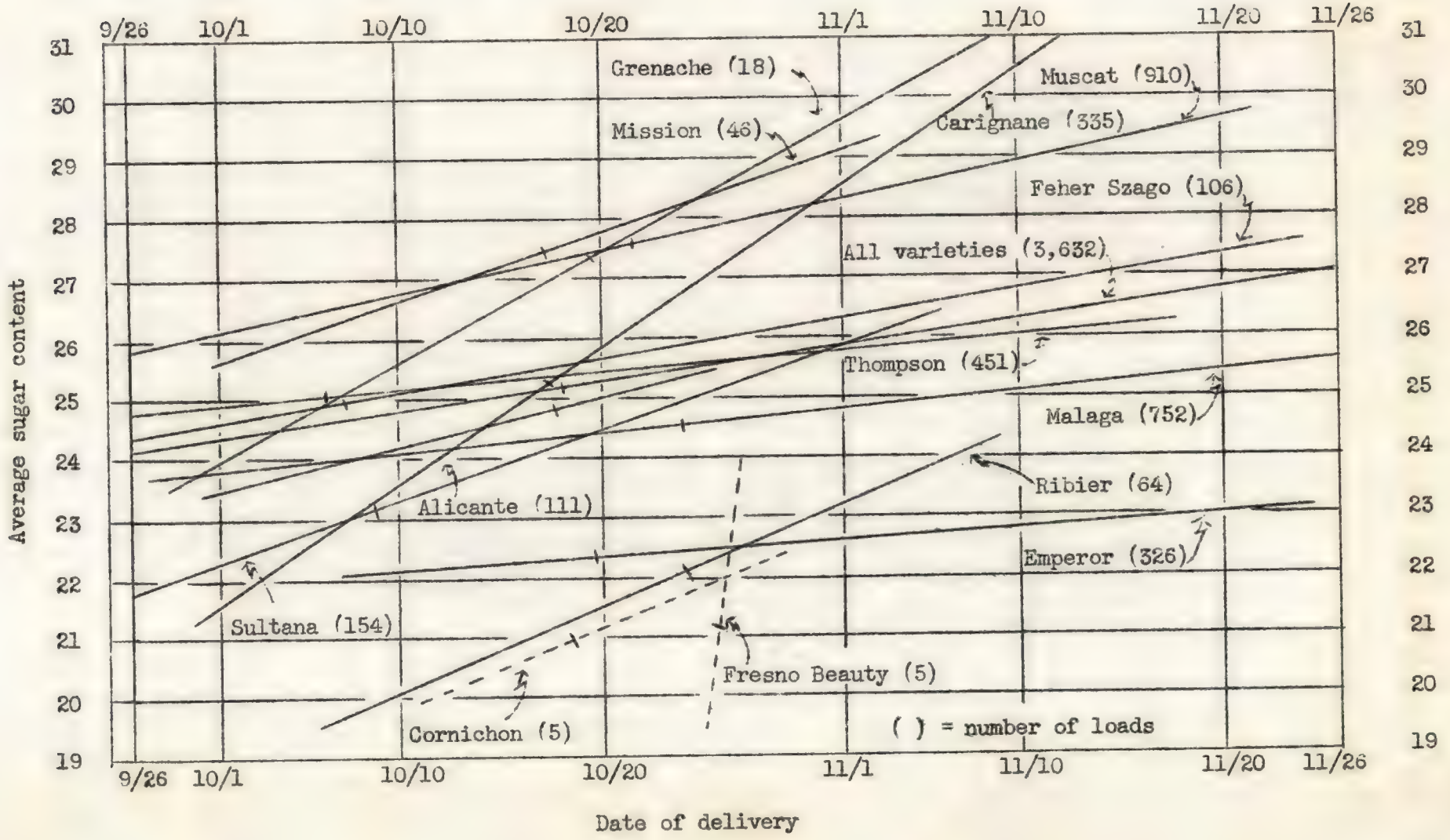


FIGURE 11

Intraseasonal Trends in Daily Average Sugar Content Grapes Delivered, by Varieties, Winery C, 1949



increase would be calculated from samples drawn from data in which the true rate was zero less than one time in 100. The rate of increase of .0174 in Winery C in 1949 compares with the rate of .059 for Winery B. Thus, while both wineries experienced increases in daily average sugar in 1949, the rate of increase for Winery C was more than three times as sharp as that for Winery B. No varieties showed decreases in reported daily average sugar content at Winery C in 1949. However, varieties differed significantly from the reported average daily changes at Winery B in the same year. Similar differences with respect to the 1948 rates are apparent.

The conclusions implicit in Figures 5 through 11 may be summarized as follows: (1) there are significant differences in both the average level of sugar for the season as a whole and in the average daily rate of change in average sugar content of grapes among varieties received within a single season at a given winery; (2) there are significant differences between seasons in both average sugar and in intraseasonal trends for grapes received at a given winery; (3) there are significant differences in season averages and in intraseasonal trends both for all grapes crushed and for specific varieties received at different wineries in the same season; and (4) there are significant differences in the variations between seasons in both season average sugar and in intraseasonal trends--again both for all grapes and for specific varieties--among different wineries.

In 1947 average sugar content decreased ten times faster for Winery A than for Winery B. In the same year, the rate of daily average decrease was twelve times faster for grapes delivered to Winery C than to Winery B. In 1948 grapes delivered to Winery C--which had decreased rapidly in the preceding year--gained in sugar at an average rate more than five times as high as that of Winery B. The situation was reversed again in 1949. In that year, the daily average rate of gain for all varieties was more than three times higher at Winery B than at Winery C. For either of the wineries, the differences in estimated daily average rates of change in sugar content between the three years were sharp and statistically significant. These same results appear when comparison is made of the separate varieties. There is no stability within a given year in the intraseasonal trends of sugar content either for individual varieties or for all varieties taken together as between different wineries. There is no stability in the all varieties or individual varieties trends for grapes delivered to a given winery over several seasons.

Thus, the bases for prediction of the impact of sugar minima upon volume crushed in any classification seem inadequate. There is insufficient stability over time effectively to predict either season average sugar, the dispersion of individual load readings about the average, or intraseasonal trends upon the basis of available records. The sharp variation among varieties and among receiving wineries within a single season means that the impact of specified minima upon varieties and upon individual wineries would be significantly different. The effects of such limitation over time would vary both for a given winery and for different wineries over several seasons. The differences appear to be sufficient to engender considerable doubt of the feasibility of a limitation program based upon specification of minimum sugar content of grapes received for crushing.

In 1947 minimum sugar specification sufficient to limit tonnage crushed would have automatically imposed closing dates on crushing of many varieties if it were effectively to limit tonnage. However, it would have denied access to the winery to some varieties. Others would have been unaffected. Closing dates

The conclusions implicit in Figures 5 through 11 may be summarized as follows: (1) there are significant differences in both the average level of sugar for the season as a whole and in the average daily rate of change in average sugar content of grapes among varieties received within a single winery on a given day; (2) there are significant differences between seasons in both average sugar and in intraseasonal trends for grapes received at a given winery; (3) there are significant differences in season, varietal and intraseasonal trends both for all grapes crushed and for specific varieties received at different wineries in the same season; and (4) there are significant differences in the variations between seasons in both season average sugar and in intraseasonal trends--again both for all grapes and for specific varieties--among wineries.

In 1917 average sugar content decreased ten times faster for Winery A than for Winery B. In the same year, the rate of daily average decrease was twelve times faster for grapes delivered to Winery C than to Winery B. In 1919 grapes delivered to Winery C--which had decreased rapidly in the preceding year--increased in sugar at an average rate more than five times as high as that of Winery B. The situation was reversed again in 1919. In that year, the daily average rate of change in sugar content between the three years was smaller for Winery C. For either of the wineries, the differences in estimated daily average rates of change in sugar content between the three years were significant for all of the separate varieties. There is no stability within a given year in the intraseasonal trends of sugar content either for individual varieties or for all varieties taken together as between different wineries. There is no stability to a given winery over several seasons.

Thus, the bases for prediction of the impact of sugar minima upon volume crushed in any classification seem inadequate. There is insufficient stability over time effectively to predict either season average sugar, the dispersion of individual load readings about the average, or intraseasonal trends upon the basis of available records. The sharp variation among varieties and among receiving wineries within a single season means that the impact of specified minima upon varieties and upon individual wineries would be significantly different. The effects of such limitation over time would vary both for a given winery and for different wineries over several seasons. The differences seem to be sufficient to engender considerable doubt of the feasibility of a limitation program based upon specification of minimum sugar content of grapes received for crushing.

In 1917 minimum sugar specification sufficient to limit tonnage crushed it were effectively to limit tonnage. However, it would have denied growers to

and percentages of elimination would have varied widely among wineries, varieties, areas of origin, and times within the harvest season. In 1948, effective minimum sugar requirements would have imposed opening dates upon the crushing of grapes. Again, there would have been wide variations with respect to access to wineries among areas of origin, varieties, and times of harvest. Similar conclusions are applicable to the 1949 season. Here, certain varieties would have been entirely excluded. It is doubtful that volume could have been controlled in any of these years through specification of sugar minima without serious administrative and equity difficulties. At the least, growers and vintners would be induced to shift normal harvesting and crushing schedules in order to avoid the effects of sugar regulations upon timing of their operations.

There are three years of data in this analysis. There is at present no basis to identify and measure the determinants of these patterns of variation among varieties, wineries, areas, and seasons. Thus, there is no way to forecast the pattern of sugar levels and trends into the future. Nonetheless, in the three years for which data are available, such a control would clearly have been inequitable and impracticable. There is no reason at the moment to assume that more stable relationships will prevail in the future.

All Varieties, One Winery, Different Seasons.--For Wineries B and C, the general intraseasonal trend for 1947 was negative. The 1948 and 1949 intraseasonal trends were positive. Differences in slope of the trends for the same winery over two or more seasons are statistically significant. So far as control is concerned, this means that the impact of a given minimum sugar requirement upon the same winery would differ over the years in two major respects: (1) the volume eliminated would differ and (2) the time distribution of such elimination within the season would also differ.

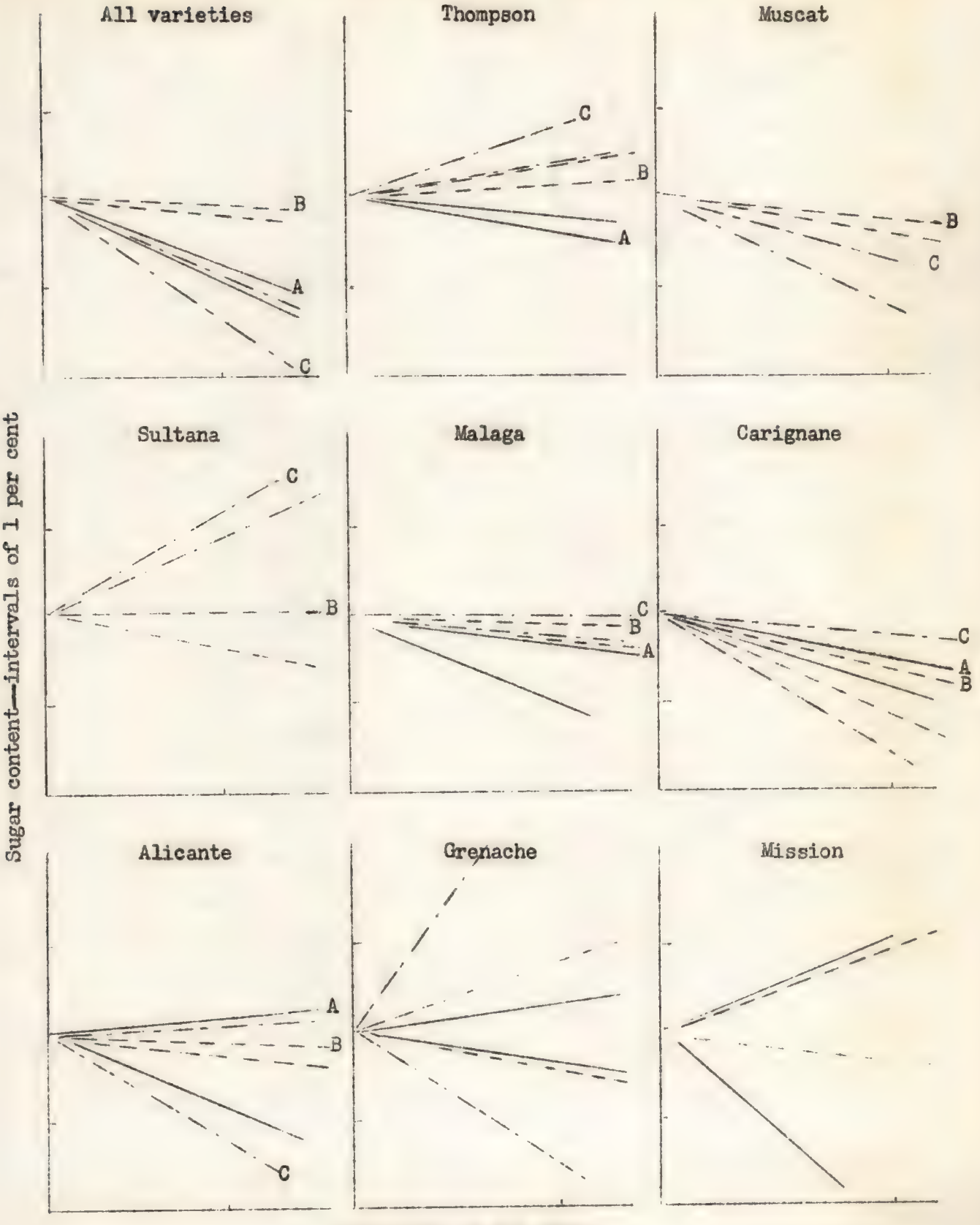
The variation in intraseasonal trends from one year to another was also tested by calculating intraseasonal trends for the combined crush, excluding culls, of Wineries B and C in each of the three years 1947-1949. In 1947, the estimated combined tonnage crushed was about 54,000 tons. The estimated combined crush for 1948 was about 75,000 tons and for 1949 about 55,000 tons. In 1947 the average sugar content of all varieties crushed at the two wineries decreased on the average by .006 per cent per day. Thus, there was practically no intraseasonal trend for the aggregate tonnage. The average sugar content for all grapes crushed by the two vintners for the season as a whole was 22.5 per cent. In 1948 the season average sugar content was 23.0 per cent. In this year average sugar for all varieties crushed at the two wineries increased during the season at the average daily rate of .118 per cent. In 1949 the season average for the two wineries combined was 24.7 per cent. Average sugar content increased during the season at an average daily rate of .034 per cent. Differences in both means and trends were statistically significant.

Thus, for aggregated tonnage, there were no stable relationships between level of season average sugar content and the pattern of intraseasonal change. By either criterion, limitation of crush through any specified minimum sugar requirement would have had significantly different effects over the three seasons.

All Varieties, Different Wineries, One Season.--If intraseasonal trends for all varieties crushed differ among wineries in a given year, volume control through minimum sugar specification would affect the operations of the wineries differently. In Figure 12, the 95 per cent confidence intervals about the slopes of the "all varieties" crushed by each of the three wineries in 1947 are shown.

FIGURE 12

Estimated Daily Average Change in Sugar Content and 95 Per Cent Confidence Intervals, by Varieties, Wineries A, B, and C, 1947



The same intervals are shown for the aggregate crush of each of eight varieties for each of the three wineries in 1947. The vertical axis indicates sugar content; the horizontal axis indicates date of harvest. The units indicated on the vertical axis measure 1 per cent; the units on the horizontal axis measure a change of ten days. These charts do not compare levels of the various trends. They test only the statistical significance of the average rates of daily change in sugar content.33/

The "all varieties" chart indicates clearly that the average daily rates of change in sugar content of grapes delivered to Winery B in 1947 differ significantly from those of Wineries A and C. By the criteria used here, the rates of change in unloads at Wineries A and C did not differ significantly in 1947. Rates of change in other years in deliveries to the wineries may be compared by reference to Table 7 and to Figures 5 through 11.

One Variety, Different Wineries, One Season.--This question is answered for eight varieties and for 1947 by Figure 12. The daily rate of change in sugar content of Thompson grapes delivered to Winery A was significantly different from the trends for Thompsons delivered to Wineries B and C. The average daily changes were significantly different for Wineries B and C with respect to Muscats and Sultanas. There are no other significant differences among the varieties shown here for 1947, although the reliability of the estimates of daily average changes in sugar contents varies widely among the three wineries.

One Variety, One Winery, Different Seasons.--Figures 13 and 14 are set up like Figure 12 except that they compare 95 per cent confidence intervals about average daily rates of change for grapes delivered to the same winery in different years. Figure 12 compares confidence intervals about the estimated daily average changes in sugar content by variety of grapes delivered to different wineries in the same year. The vertical axis of Figures 13 and 14 are calibrated to the same units as in Figure 12. Each marked unit indicates one percentage point in sugar content. Each marked unit on the horizontal axis indicates ten days. Again, only the significance of the differences of the average daily rates of change are measured here. The levels of the trends are not compared. As in Figure 12, the width of the angles may be taken as rough indices of the relative statistical reliability of the various estimates of daily average change in sugar content.

The two sets of charts support the conclusions drawn earlier. For both wineries and for most varieties, daily average sugar content decreased as the season progressed in 1947. For Winery B, the average daily sugar content increased during the seasons of 1948 and 1949, although there were no significant differences between the two years for that winery by the criteria used here. The differences indicated by these two charts may be exemplified by the following examples: for "all varieties," the 1949 rates for Winery B differed significantly from the 1947 and 1948 rates--the 1947 and 1948 rates did not differ significantly; for Winery C, the rates for all varieties were significantly different over all three years since none of the confidence intervals overlap.

- -

33/ The fan-shaped arcs in Figure 12 really compare the relative changes in sugar over the same number of days for the various classifications.

The same intervals are shown for the aggregate result of each of eight varieties for each of the three selected in 1947. The vertical axis indicates sugar content; the horizontal axis indicates date of harvest. The units indicated on the vertical axis measure 1 per cent; the units on the horizontal axis measure a change of ten days. These charts do not compare levels of the various trends. They test only the statistical significance of the average rates of daily change.

The "all varieties" chart indicates clearly that the average daily rates of change in sugar content of grapes delivered to Winery B in 1947 differed significantly from those for Wineries A and C. By the criteria used here, the rates of change in varieties for Wineries A and C did not differ significantly in 1947. Rates of change in other years in deliveries to the wineries may be compared by reference to Table 7 and to Figures 5 through 11.

[illegible]

[illegible]

No Variety, One Winery, Different Seasons.--Figures 13 and 14 are charts like Figure 12 except that they compare 95 per cent confidence intervals about average daily rates of change for grapes delivered to the same winery in different years. Figure 13 compares confidence intervals about the estimated daily average change in sugar content by variety for grapes delivered to different wineries in the same year. The vertical axis of Figures 13 and 14 are calibrated to the same units as in Figure 12. Each marked unit indicates one percentage point in sugar content. Each marked unit on the horizontal axis indicates ten days. Again, only the significance of the differences of the average daily rates of change are measured here. The levels of the trends are not compared. As in Figure 12, the width of the engine may be taken as rough indices of the relative statistical reliability of the various estimates of daily average change in [illegible].

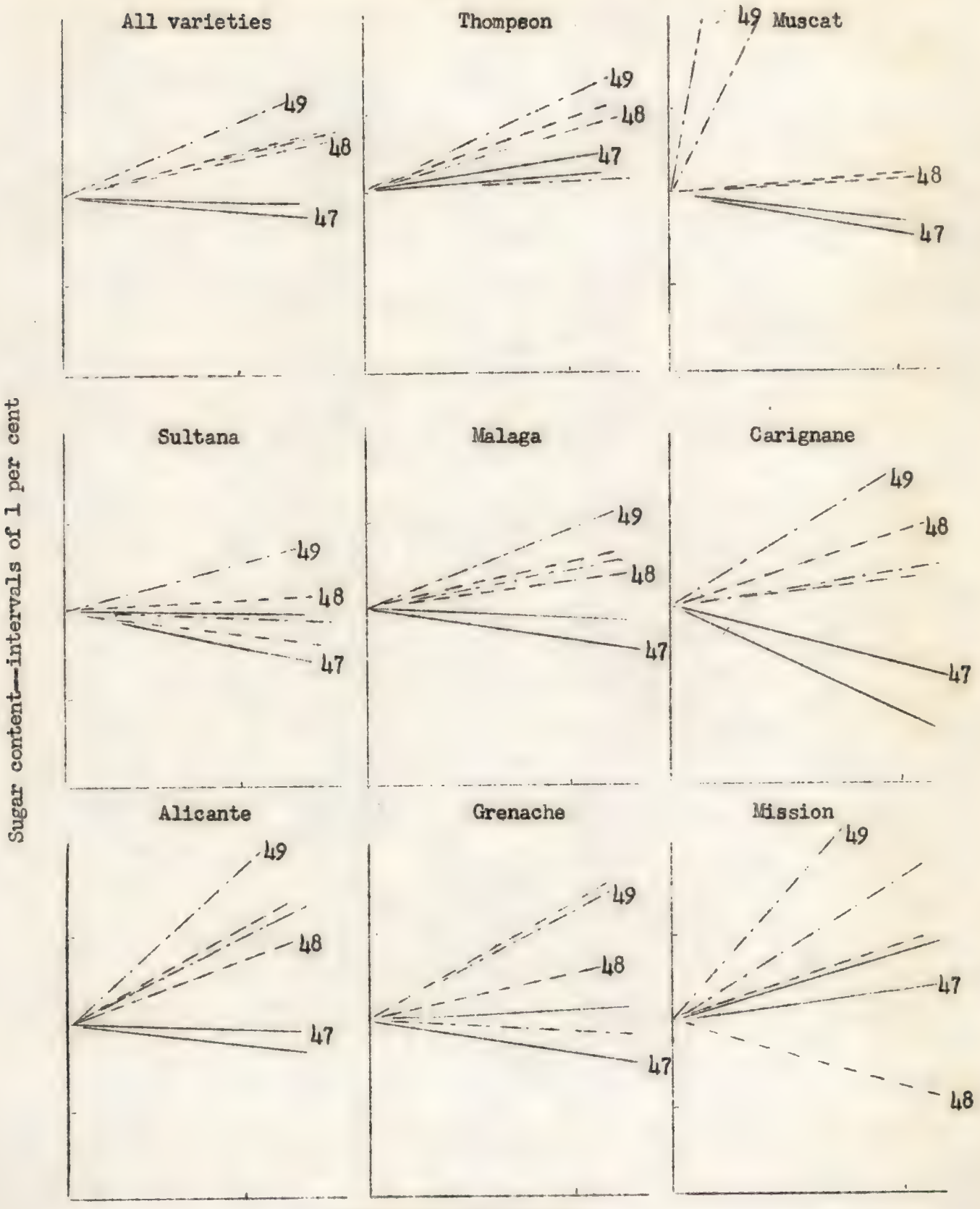
The two sets of charts support the conclusions drawn earlier for both wineries and for most varieties, daily average sugar content increased as the [illegible] increased during the seasons of 1948 and 1949, although there were no significant differences between the two years for that winery by the criteria used here. The examples for "all varieties"--the 1947 and 1948 rates did not differ significantly from the 1947 and 1948 rates--the 1947 and 1949 rates did not differ significantly; for Winery C, the rates for all varieties were significantly different over all three years since none of the confidence intervals overlap.

[illegible]

[illegible] over the same number of days for the various classifications.

FIGURE 13

Estimated Daily Average Change in Sugar Content,
and 95 Per Cent Confidence Intervals,
By Varieties, Winery B, 1947-1949



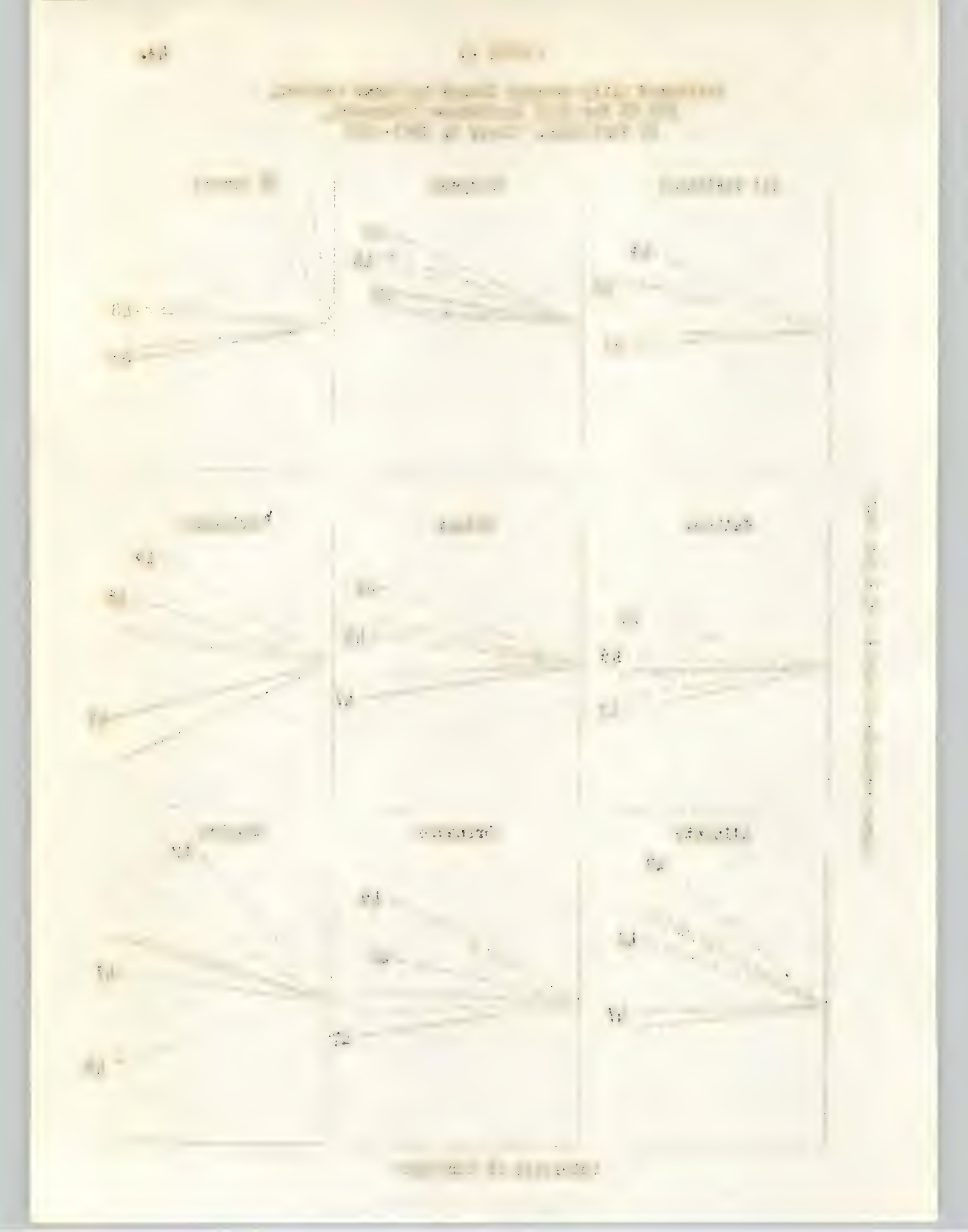
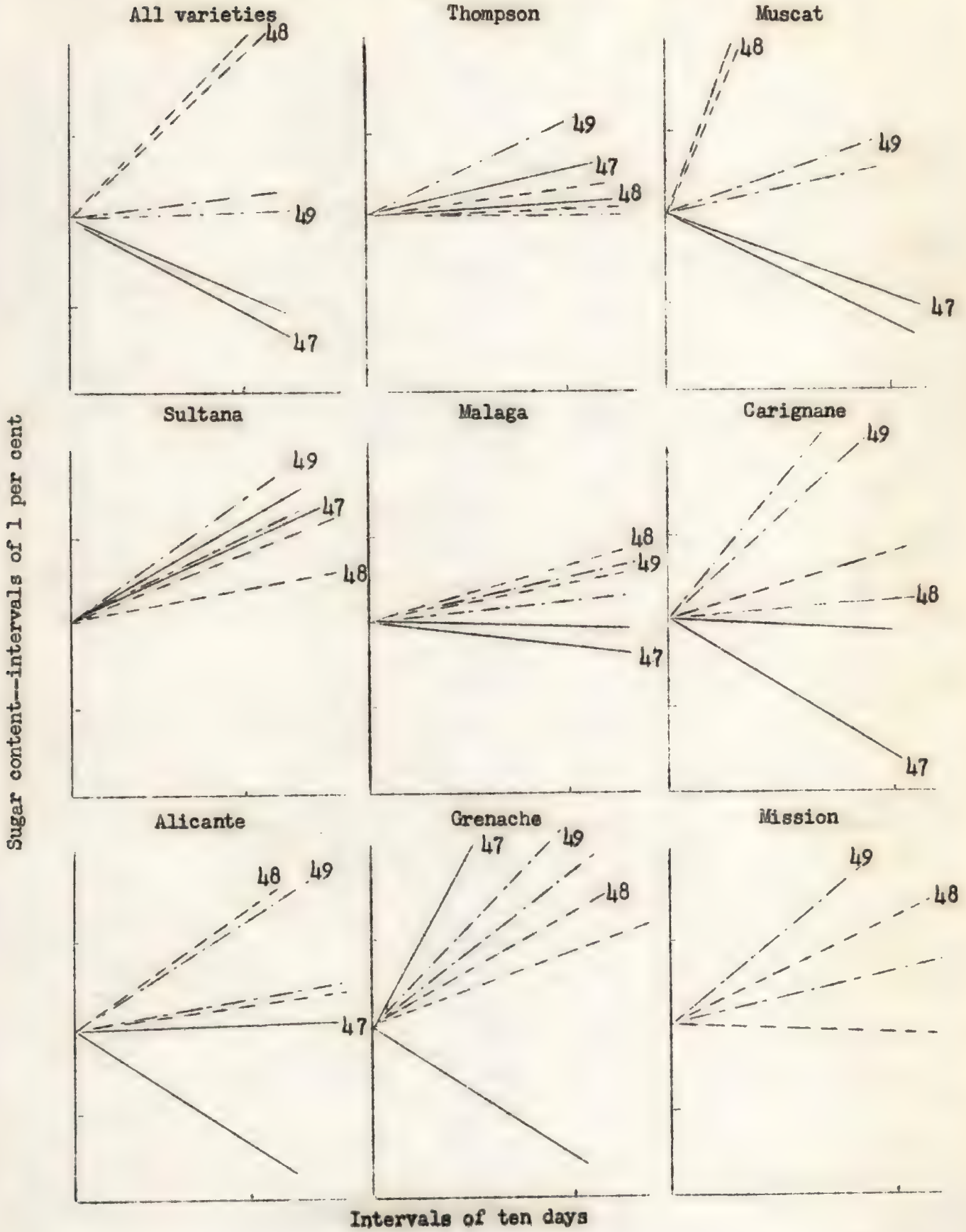
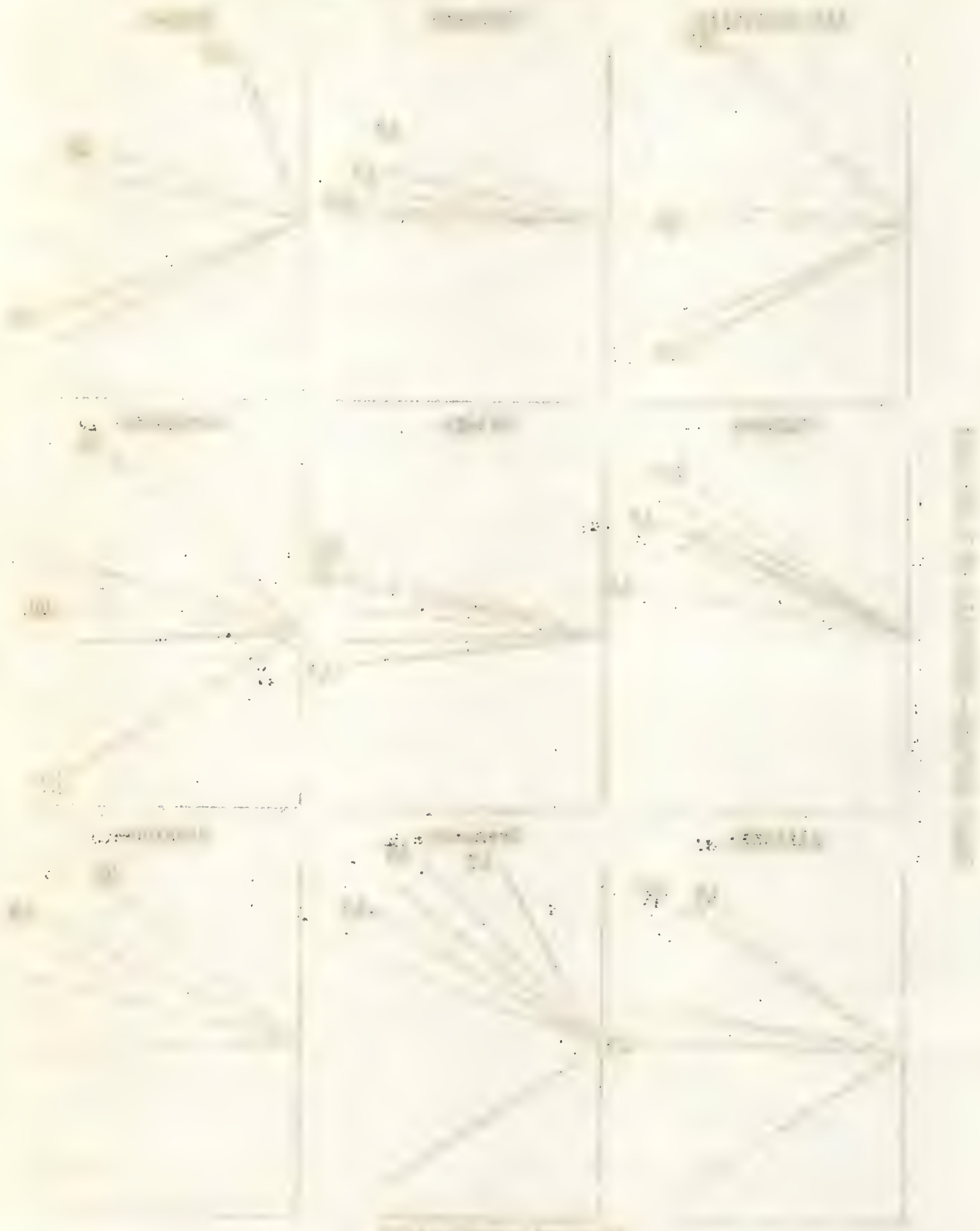


FIGURE 14

Estimated Daily Average Change in Sugar Content
and 95 Per Cent Confidence Intervals,
by Varieties, Winery C, 1947-1949





There were no significant differences among Thompsons over the three seasons for Winery C. The 1947 and 1948 rates differed significantly for Winery B. The rates for Muscats differed significantly for both wineries over all three years. The Carignane rates differed significantly over all three years for Winery C, but the differences between 1948 and 1949 were not significant for Winery B. Alicante rates differed significantly in all three years for Winery C, but again the differences between 1948 and 1949 rates were not significant for Winery B. There are general and significant differences in rates of change in sugar over seasons.

Year-to-year changes in trends of several varieties are shown in Figure 15. In general, trends were higher in 1948 than in 1949 for this winery. For many of the varieties, the average daily rates of change did not differ greatly between those two years. For others--such as Mission, Muscatel, Mourastel, Feher Szago, and Zinfandel--trends differed sharply in slope as well as level. In general, trends for 1947 were lowest and most frequently negative. Yet, 1947 trends were positively inclined for Mission and Petite Sirah. This chart and the tables from which it was drawn again support the general findings that neither trends nor season averages are stable over the years.

Areas of Origin.--This question must be divided into several subsidiary issues.

Figure 16 indicates differences in the estimated intraseasonal trends of all grapes crushed at Winery C from six areas of origin over the three years, 1947-1949. Trends for other areas are shown in Table 8. In any one of the years, the levels of the trends differ among various origins and, for any year, the slopes of the estimated trends differ among the areas. Thus, in 1947 slopes of trends were negative for all areas shown except Parlier. Among the areas for which 1947 trends were negative, the daily average rates of change in sugar content differed widely.

The differences in trends for any area over the three years are also indicated by Figure 16. Thus, all 1948 trends shown are positively sloped, indicating that sugar content increased as the season progressed for all the areas. Nonetheless, the slopes differ and there seems to be little systematic relationship between the characteristics of the trends in each area over various years. The trends for the several areas show a mixed pattern for 1949. Grapes delivered to this winery from Clovis, Ivanhoe, and Sanger showed negative intraseasonal trends. Yet, in most cases the level of the 1949 trend was higher than that of 1948 which in turn was generally higher than that of 1947. Accordingly, when trends are considered by areas, there appears the same lack of systematic pattern in the variation of sugar attributes by areas, varieties, seasons, or receiving wineries. Trends for other areas and wineries show the same lack of stability. Different wineries would not be affected in the same way in any one season. No single winery would be affected the same way in different seasons. The difference in impact of a given sugar minimum from one year to another would differ among wineries. No varietal classes would be affected similarly in any season nor would the differences in impact over time be similar among varietal classes. Finally, areas of origin would also be affected differently with respect to the impact upon the eligibility of total area production of minimum sugar specification either in a single season or over several seasons.

Season average sugar content, variances, and daily average rates of change in sugar are shown in Table 8 for 31 areas of origin of grapes crushed at Winery C in one or more of the three years. Within each one of the years, the season

rates for Muscata differed significantly for both winterlev over all three years. The Cardigans rates differed significantly over all three years for Winery C, but the differences between 1943 and 1945 were not significant for Winery B. Allicante rates differed significantly in all three years for Winery C, but again there are general and significant differences in rates of change in sugar over seasons.

Year-to-year changes in trends of several varieties are shown in Figure 15. In general, trends were similar in 1944 and 1945 for the varieties, the average daily rates of change did not differ greatly Scarlet, and Zinfandel--trends differed sharply in slope de well as level. neither trends nor season averages are stable over the years.

Areas of Origin.--This question must be divided into several subsidiary

Figure 16 indicates differences in the estimated intraseasonal trends of grapes produced at Winery C from six areas of origin over the three years, 1943-1945. Trends for other areas are shown in Table 8. In any one of the years, the levels of the trends differ among various origins and, for any area, from year to year. In 1944 all trends were negative, the daily average rates of change in sugar content differed widely.

The differences in trends for any area over the three years are also indicated by Figure 16. Thus, all 1943 trends show more positively sloped, indicating that sugar content increased as the season progressed for all the areas. Nonetheless, the slopes differ and there seems to be little systematic relationship between the levels of the trends among various origins and, for any area, the slopes. The trends for the several areas show a mixed pattern for 1945. Grapes matured at widely different rates in 1945 and the level of the 1945 trend was higher than when trends are considered by areas, there appears the same lack of systematic pattern in the variation of sugar attributable by areas, varieties, seasons or receiving wineries. Trends for other areas and wineries show the same lack of stability. Different wineries would not be affected in the same way in any season. No single winery would be affected the same way in different seasons. The difference in impact of a given sugar minimum from winery to winery could differ among wineries. No varietal classes would be affected similarly in any season. Moreover the differences in impact over time in diminishing various classes. Finally, areas of origin would also affect differently with respect to the impact upon the eligibility of varietal lots produced at minimum sugar specification either in a single season or over several seasons.

Season average sugar content, variances, and daily average rates of change in sugar are shown in Table 8 for 34 areas of origin of grapes crushed at Winery C in one or more of the three years. Within each one of the years, the season

FIGURE 15

Intraseasonal Trends in Average Sugar Content,
by Varieties, Winery B, 1947-1949

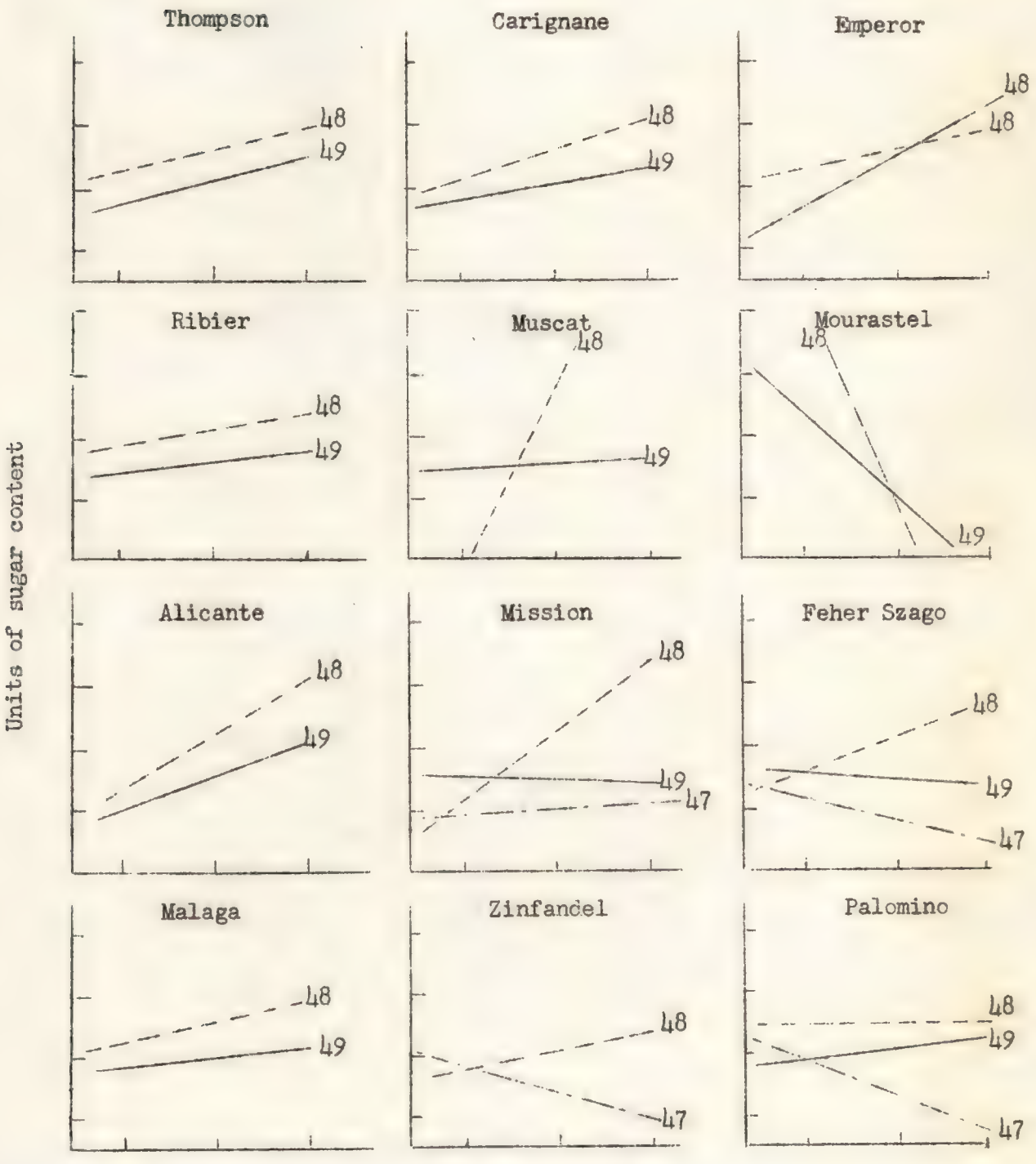
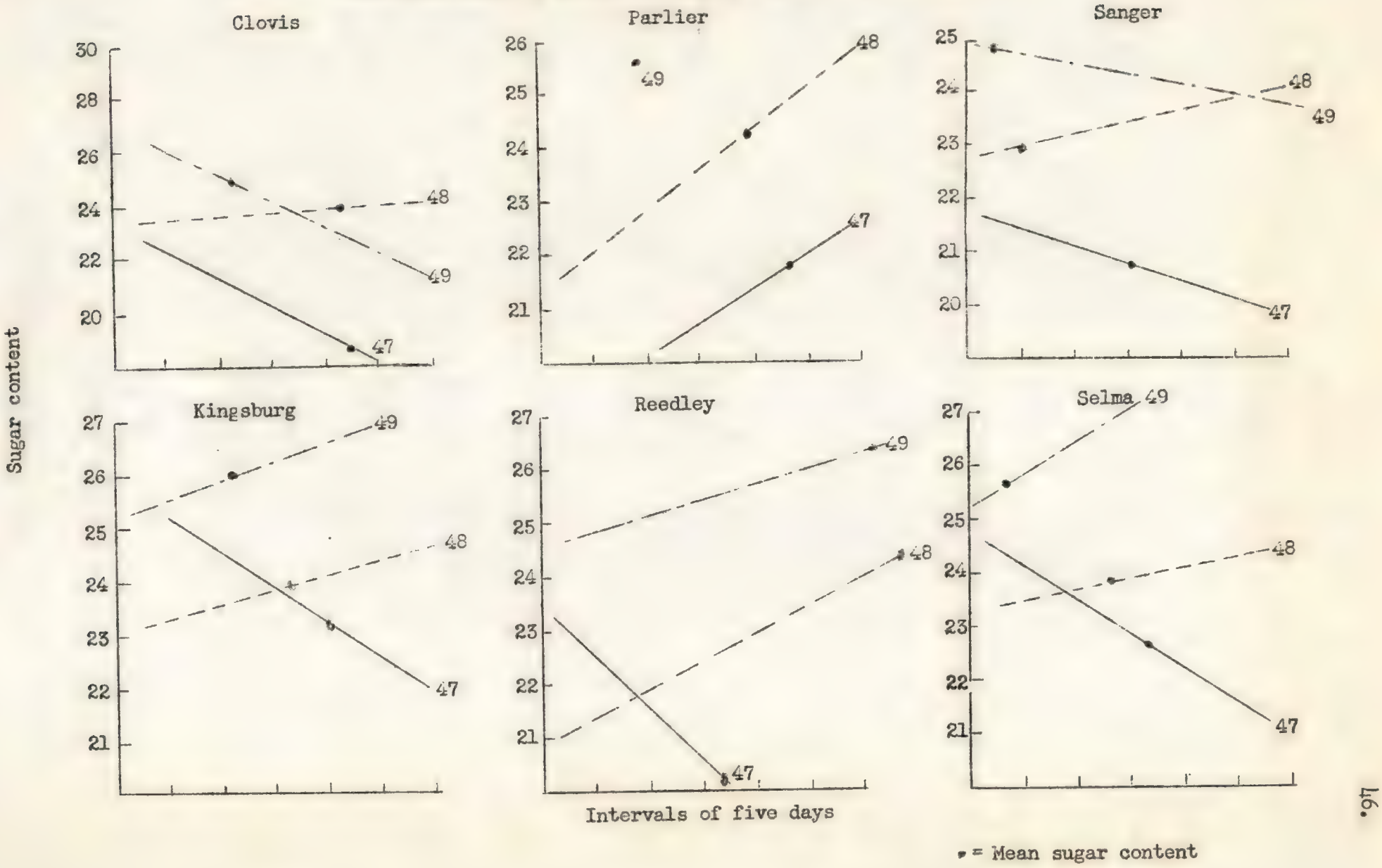


FIGURE 16

Estimated Daily Average Change in Sugar Content,
All Varieties, by Areas of Origin, Winery C, 1947-1949



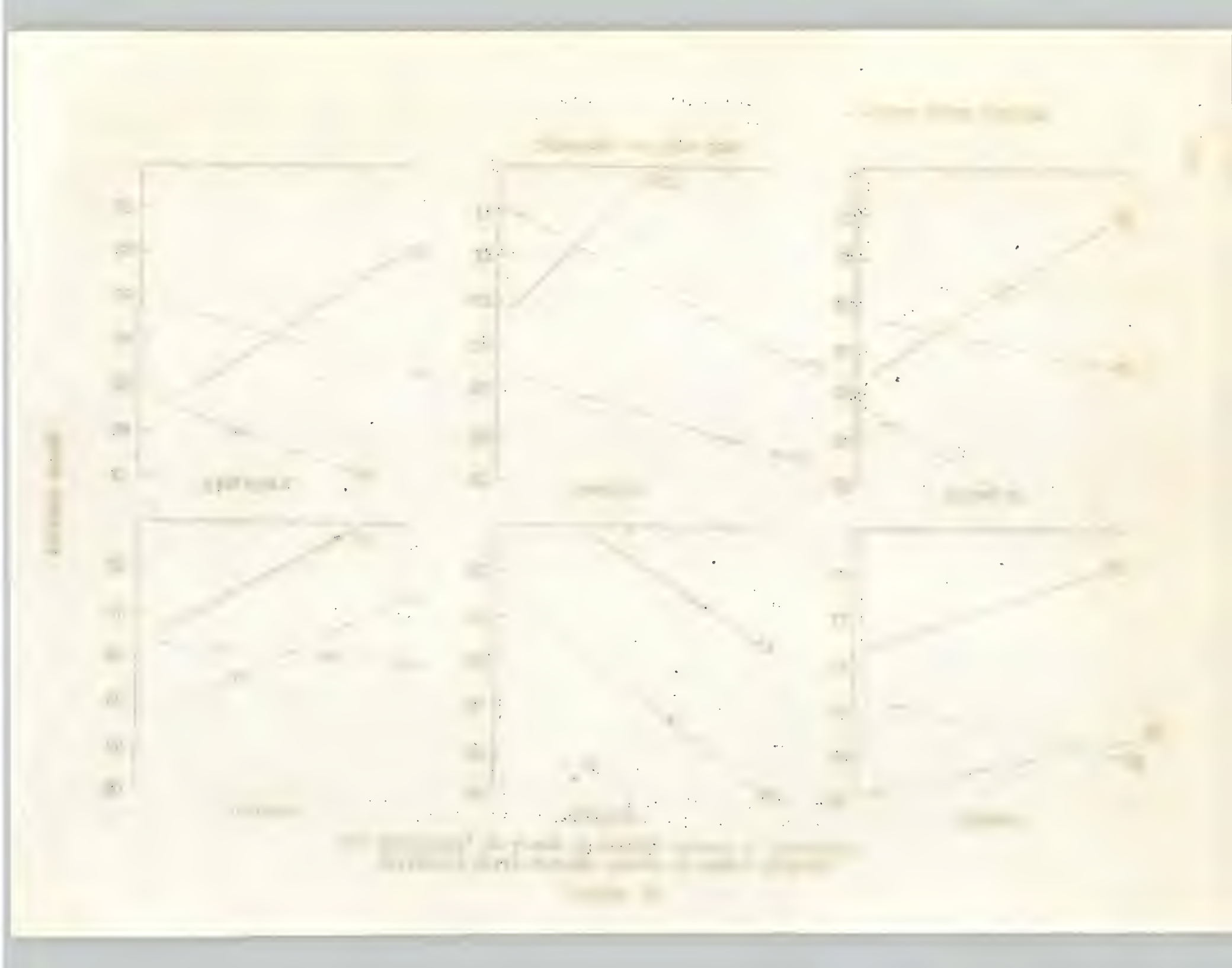


TABLE 8

Estimated Season Average Sugar Content, Variance and Daily Average Change in Sugar Content, All Varieties, by Area of Origin, Winery C, 1947-1949

Area	Number of loads			Mean sugar level			Variance			Regression			"t" value		
	1947	1948	1949	1947	1948	1949	1947	1948	1949	1947	1948	1949	1947	1948	1949
Caruthers	17	14		19.94	21.41		.7	.3		-.011	.077		.37	1.33	
Clotho			38			24.6			16.0			-.046			.85
Clovis	85	258	242	21.33	23.91	24.5	5.2	2.0	5.0	-.113	.012	-.075	4.71[a]	2.11[b]	5.77[a]
Del Rey	32	56	76	23.39	23.48	25.0	3.4	1.9	4.4	.028	.023	.048	.68	1.64	2.09[b]
Dinuba	7	24		19.57	21.64		2.7	31.9		-.118	-.114		5.90[a]	1.14	
Exeter	78	87	138	18.86	23.57	23.2	2.8	1.7	6.9	.001	.010	.052	.05	1.01	2.17[b]
Fowler	62	96	149	22.06	19.14	25.1	4.3		5.0	-.028	.007	.039	.85	.64	1.86
Fresno	913	1,190		21.26	23.46		6.5	3.0		-.847	.036			16.36[a]	
Hanford		78	29		24.55	27.2		2.2	13.3		.038	.398		3.17[a]	10.37[a]
Herndon	5			21.00			1.5			-.382					
Hughson		4	4		21.50	24.1		2.0	.5		.217	-.187			
Ivanhoe	227	37	16	18.56	22.75	24.6	2.8	2.7	2.2	-.054	.011	-.116	5.40[a]	.56	3.87[a]
Kerman	34	9	5	20.96	22.61	28.3	2.3	1.2	30.8	.269	-.215	.594		2.91[b]	
Kingsburg	202	459	412	22.13	23.82	25.9	6.2	2.0	3.2	-.139	.052	.066	7.32[a]	15.79[a]	7.59[a]
Laton			5			24.7			.6			1.5			
Lemoore		10			23.23			1.4			1.135				
Lodi	5	212		23.60	21.37		4.3	3.7		.720	-.001			.03	
Madera	102	85	101	21.36	22.43	23.7	6.8	1.2	2.4	.046	.023	.092	1.24	3.29[a]	7.08[a]
Merced			2			25.2			.04			.100			
Modesto		32			22.92			1.9			.172			3.25[a]	
Orange Cove			50			23.0			5.6			-.044			.80
Parlier	141	148	215	21.80	24.29	25.6	5.4	3.5	10.9	-.133	.148	.047	5.54[a]	17.62[a]	.56
Reedley	50	80	170	20.23	24.44	26.4	11.1	2.8	7.0	-.198	.114	.053	2.48[b]	8.14[a]	2.24[b]
Ripon		9			21.29			.2			.034			.81	
Salida		9			22.39			1.1			-.068			.47	
Sanger	234	411	309	20.79	22.95	24.9	3.9	2.7	4.1	-.064	.043	-.039	5.82[a]	10.75[a]	3.86[b]
Selma	167	397	385	22.67	24.32	25.6	5.8	1.9	4.5	-.136	.041	.120	8.50[a]	11.39[a]	16.00[a]
Terra Bella			6			27.0			3.3			.226			
Turlock		51	49		25.68	25.1		8.4	3.2		.463	.097		10.92[a]	2.52[b]
Visalia	21		4	17.93		25.8	1.4		.3	-.040		-.153	1.43		
Winton		4	18		23.15	25.1		3.0	6.4		-.567	.357			7.23[a]

a/ Highly significant.

b/ Significant.

| | | |

averages differed sharply. There were also wide differences within each of the years among the variances about the season averages. Within each one of the years, the average daily rates of change varied widely among the areas of origin, with both positive and negatively inclined trends among the areas. The between years patterns for the various areas of origin are quite similar. Season average sugar and variance for grapes from the same area delivered to the same winery in different years both differed sharply. The trends for given areas showed quite as much variation from year to year. On the basis of these data, two conclusions seem well supported: (1) in any given year, the impact of minimum quality regulations would vary widely among areas and (2) there is insufficient stability in these measures accurately to predict over time the effects of quality control in any particular area.

Loads to Winery A from nine areas in 1949 were analyzed separately. Results are summarized in Table 9. Trends were statistically significant for seven of the classifications. Average daily changes in sugar content within that single year varied from a decrease of about $\frac{1}{2}$ per cent to an increase of about $\frac{1}{4}$ per cent. In 1949 minimum sugar requirements would not merely have resulted in different percentages or tonnages eliminated. Some areas would have had to conform to closing dates since trends were sharply negative. Others might have been required to defer opening dates for crushing.

TABLE 9

Estimated Daily Average Change in Sugar Content,
Thompson Grapes, by Areas of Origin, Winery A, 1949

Production area	Number of truckloads sampled	Regression coefficient b_{yx}	"t" value	Level of significance per cent
Ceres	37	.0392	1.4792	80
Escalon	78	.0077	.3850	a/
Manteca	44	.0490	2.8324	99
Modesto	244	.0236	2.3600	99
Oakdale	13	.1454	3.1747	99
Ripon	76	.2299	8.1237	99
Riverbank	10	-.5285	2.4099	95
Salida	14	-.0558	1.2798	70
Turlock	15	.1847	2.9599	99
All areas	531	.0274	2.7400	99

a/ Not significant.

The effects of sugar control upon individual varieties from particular areas of production are indicated for several varieties and areas in Figure 17. In any given year, there were differences in the trends for the same variety among different areas of origin. The trends for different varieties from the same area in the same year were of course different. For any variety, the trends differed widely in different seasons for given areas of production. Finally, for any area of production the trends in different years were significantly different in many cases. In general, the 1949 trends were highest--followed by 1948--but there were many exceptions, and the slopes for given varieties from given areas differed widely among areas.

FIGURE 17a

Estimated Intraseasonal Trends in Daily Average Sugar Content, by Varieties and Areas of Production, Winery B, 1947-1949

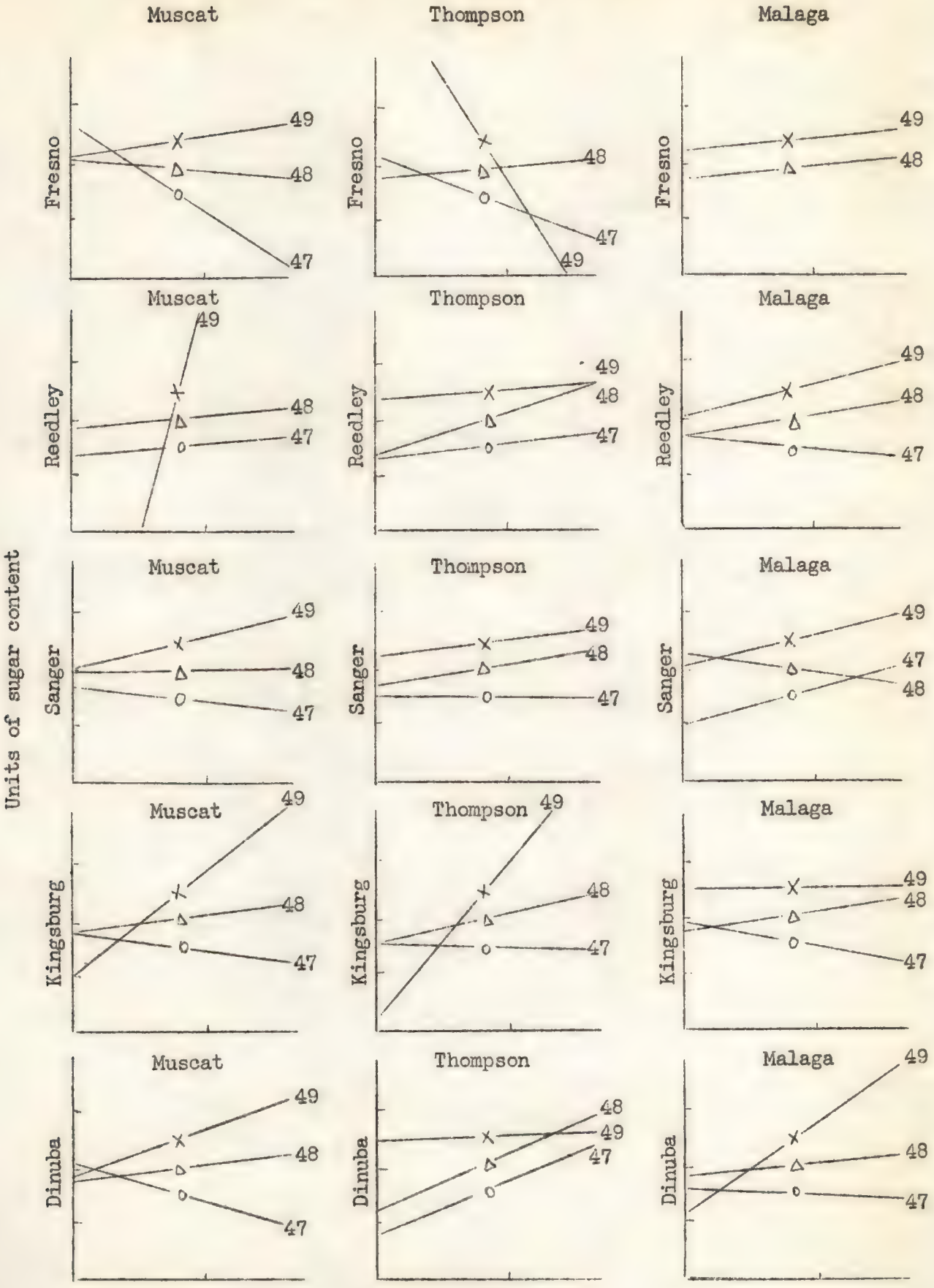
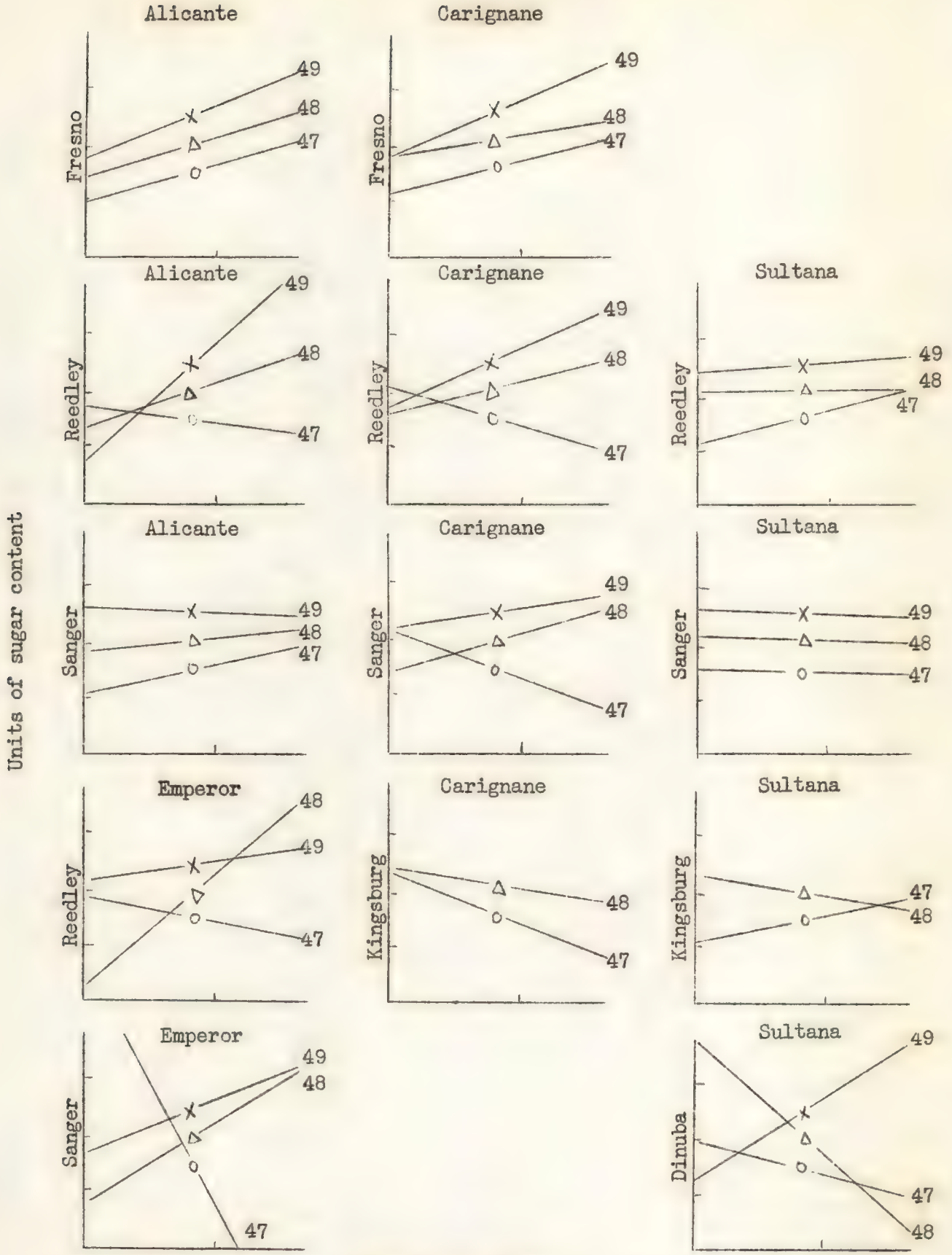


FIGURE 17b


Alicante
Carignane
Fresno
Alicante
Carignane
Sultana
Reedley
Alicante
Carignane
Sultana
Sanger
Emperor
Carignane
Sultana
Reedley
Kingsburg
Emperor
Sultana
Sanger
Dinuba
49
48
47
Units of sugar content
Unit of ten days

Thus, in 1947, trends for Muscats were negative except for Reedley. Trends for 1948 and for 1949 were uniformly positive in all areas of origin. However, both levels and trends differed among areas in any one of the three years. Over the three years, trends differed sharply in all areas. The patterns of change from one year to another were widely different among the various areas shown on the chart. Variation within and between years is similar among the varieties shown. There is no similarity in the trends for any one area of origin when several varieties are considered for one year. Thus, the Thompson trend for Fresno in 1949 was sharply negative. All others from the Fresno area were positive in that year. Trends in 1947 were negative for Muscats and Thompsons from Fresno crushed at Winery C, but trends rose in that year for Alicantes and Carignanes from the Fresno area. Whether within and between year variation be regarded by comparing different varieties from a given area or different areas producing the same variety, the conclusion is the same: there is no regularity of pattern among varieties or areas of origin either within a given season or over several seasons.

Tests were made of the significance of the differences of the trends by varieties and areas of origin. Figure 18 indicates such tests for Thompson grapes received at Winery A in 1949 from nine different areas. Again, only the significance of the differences in the average daily rates of change rather than the levels of trends is tested here. The first panel indicates that the Ripon rate for Thompsons in that year was significantly different from those of Manteca and Escalon. The Turlock rate differed from those of Modesto and Salida. The Riverbank rates differed from those of Oakdale and Ceres.

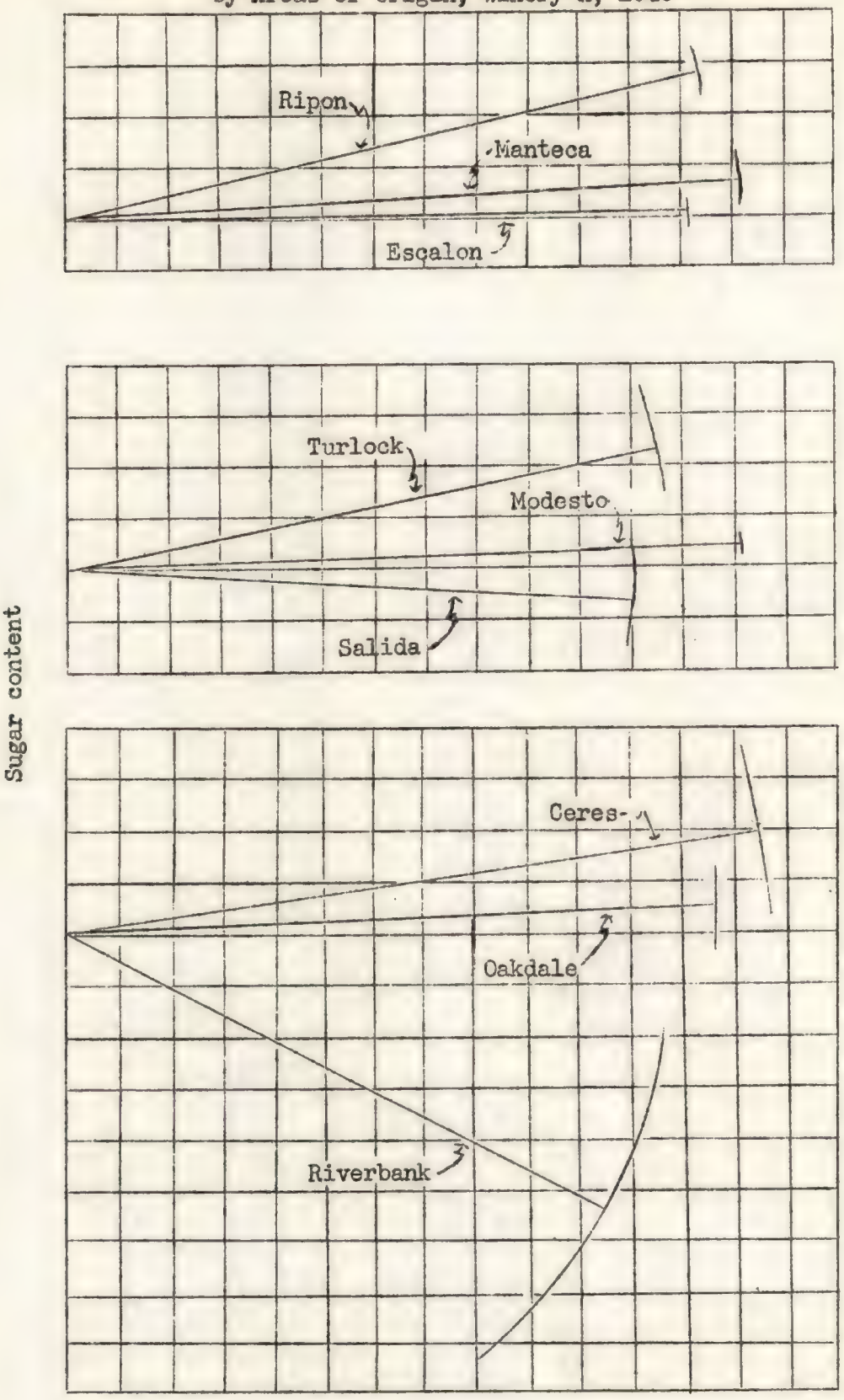
In Table 10 varieties received by the several wineries are classified according to area of origin. For each variety from each area of origin, the following measures are calculated: season average sugar content; variance or measure of dispersion of individual load readings about the season average for the particular variety from the particular area; slope or average daily rate of change in sugar content during the season; and "t" coefficients which are indices of the statistical reliability of the slopes or regression coefficients. With a breakdown of the annual receipts of the individual wineries into such narrow classifications, sample size decreases and reliability of the various coefficients therefore also decreases in general. Nonetheless, several clear-cut conclusions become obvious from inspection of these results.

Season averages for a given variety delivered to a single winery in a single season differ sufficiently to induce serious differences in percentages eliminated by any minimum sugar requirement. These differences are, however, of a generally lower magnitude than that of the variances. Nearly all of the slopes for 1947 were negative, which is consistent with other findings of the study. Petite Sirah trends were positive and highly significant statistically. Except for this variety, highly significant slopes were uniformly negative, ranging from about zero change to about .1 per cent decrease in average sugar content per day through the season. Differences in slope among varieties and areas in 1947 were sufficient to involve serious difficulty in administration of the proposed type of program.

In Table 10 are shown breakdowns by varieties, areas of origin, receiving winery, and year. For each of these cross classifications are shown the season average sugar content, variances as measures of the dispersion of individual load readings about the season averages, slopes or average daily rates of change in sugar content through the season, and "t" coefficients as indices of the statistical significance of the calculated average rates of change in sugar.

FIGURE 18

Estimated Intraseasonal Average Daily Changes in Sugar Content and 95 Per Cent Confidence Intervals, Thompson Grapes, by Areas of Origin, Winery A, 1949



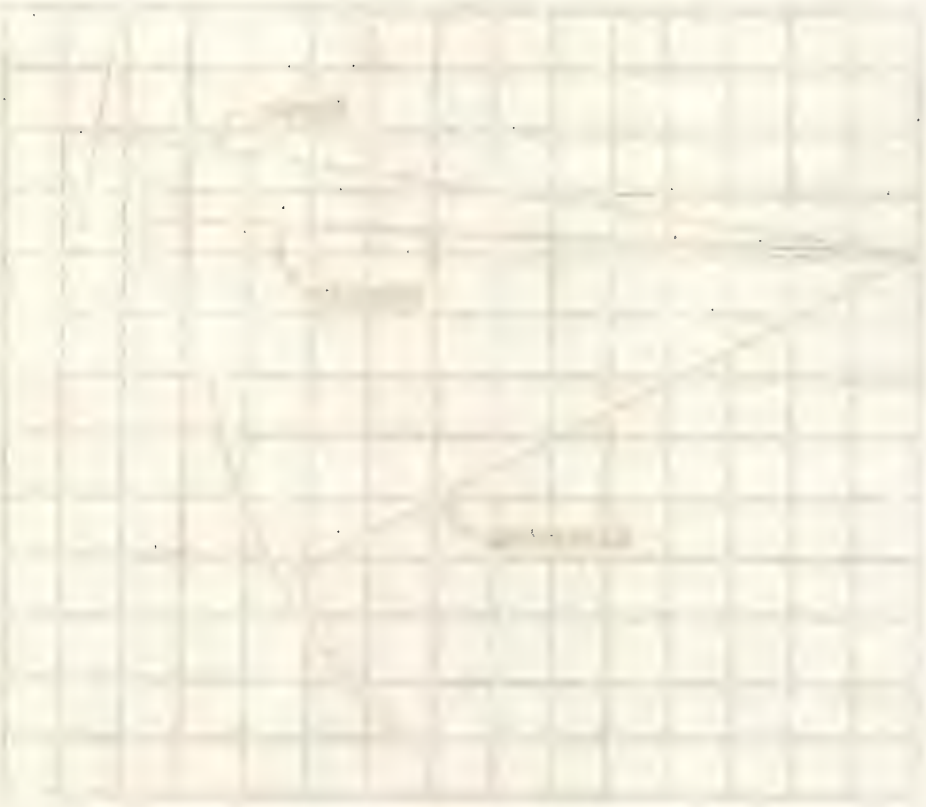


TABLE 10

Estimated Season Average Sugar Content, Variances and Average Daily Change in Sugar Content, by Varieties and Areas of Origin, Winery A, 1947, and Wineries B and C, 1947-1949

Variety and area	Season average	Variance	Slope	"t"	Variety and area	Season average	Variance	Slope	"t"
10a Winery A, 1947									
San Salvador					Alicante				
Escalon	25.71	10.63	-.2500	.37	Escalon	22.23	3.63	-.0303	.34
Mixed					Manteca	21.30	3.83	-.0249	.53
Modesto	25.04	5.27	-.2252	5.43	Modesto	20.96	2.53	-.0161	.48
All areas	25.27	5.66	-.2349	6.02	All areas	21.33	3.29	-.0408	1.68
Tokay					Thompson				
Escalon	20.76	1.30	-.0892	3.67	Atwater	23.43	2.46	-.0348	1.93
Lodi	20.48	2.26	-.0684	4.54	Escalon	23.42	2.25	-.0223	2.58
All areas	20.50	2.19	-.0714	5.21	Keyes	24.64	1.89	.0574	1.09
Mission					Manteca	24.00	1.73	-.0267	.43
Modesto	25.43	1.46	-.0196	.32	Modesto	23.79	2.50	-.0385	5.23
All areas	25.45	2.16	-.0471	.85	Turlock	23.94	2.80	-.1734	2.65
Petite Sirah					All areas	23.69	2.51	-.0293	5.59
Modesto	23.07	1.60	.0856	16.74	Grenache				
All areas	23.27	1.40	.0684	3.52	Escalon	24.06	2.02	-.0033	.08
Malaga					Modesto	24.88	2.72	-.0107	.59
Atwater	20.76	4.09	-.0540	1.44	Ripon	23.36	4.05	.5252	4.12
Escalon	21.25	3.18	-.0956	3.26	All areas	24.69	2.86	-.0006	.04
Modesto	21.34	3.51	-.0620	2.83	Carignane				
All areas	21.14	3.61	-.0610	4.29	Atwater	24.30	3.32	-.0044	.07
Zinfandel					Escalon	23.79	2.26	-.0617	4.09
Manteca	24.56	4.15	-.4292	2.70	Manteca	24.10	1.94	-.0415	1.78
Modesto	23.65	5.51	.0216	.51	Modesto	24.00	2.40	-.0549	6.36
All areas	24.00	5.25	-.0133	.35	Ripon	25.15	2.47	-.0977	2.93
					Salida	24.14	1.55	.2049	1.93
					All areas	24.02	2.39	-.0580	8.74
10b Winery B, 1947									
Petite Sirah					Alicante				
Sanger	24.01	1.83	.0288	.28	Fresno	23.29	2.47	.0711	1.63
All areas	23.88	1.69	.0538	.70	Kingsburg	24.03	.34	.0586	4.01
Mission					Manteca	22.02	4.18	-.0609	1.35
Reedley	23.57	.14	.0174	.60	Reedley	22.83	2.57	-.0324	4.75
All areas	23.33	.32	.0145	.87	Sanger	22.49	2.33	.0274	2.20
Feher Szago					All areas	22.81	2.75	-.0208	3.69
Kingsburg	23.37	1.48	-.2250	3.24	Carignane				
Reedley	20.62	3.00	-.0756	1.24	Kingsburg	24.14	5.57	-.1072	7.00
Sanger	21.76	2.44	.0155	.37	Reedley	22.87	1.92	-.0727	5.14
All areas	21.70	3.98	-.0563	1.74	Sanger	23.72	2.45	-.0807	3.58
					Manteca	23.00	2.18	-.1673	6.11
					All areas	23.27	2.46	-.0730	7.58

(Continued on next page.)

Table 10 continued.

Variety and area	Season average	Variance	Slope	"t"	Variety and area	Season average	Variance	Slope	"t"
10b Winery B, 1947 (Continued)									
Zinfandel					Malaga				
Sanger	24.42	.67	-.0315	.57	Dinuba	20.25	.39	-.0127	1.43
Reedley	24.77	1.03	.0280	.11	Kingsburg	20.89	.93	-.0433	2.78
All areas	24.65	3.11	-.0716	3.29	Reedley	20.84	2.32	-.0215	2.31
Palomino					Selma	21.78	1.31	-.0534	1.73
Fresno	23.49	1.02	.0477	1.19	Woodlake	20.15	1.04	-.0244	.93
Reedley	22.20	.78	.0969	6.75	Sanger	21.98	1.51	-.0351	4.01
Sanger	21.37	.52	.0799	.60	All areas	21.19	2.08	-.0227	4.19
All areas	22.30	1.51	.0977	7.37	Sultana				
Malvoisie					Dinuba	21.15	1.44	-.0616	2.30
Kingsburg	25.44	.77	.0333	.08	Kingsburg	22.68	1.89	.0494	1.75
Reedley	22.47	1.08	-.2013	3.46	Reedley	22.69	2.02	-.0467	3.43
Sanger	25.18	1.81	.0580	1.38	Sanger	22.47	.65	-.0102	.42
All areas	24.30	3.16	-.0110	.40	All areas	22.16	2.56	-.0220	1.88
Ribier					Thompson				
Reedley	20.43	1.63	.0026	.10	Dinuba	22.97	1.36	.1048	6.93
Sanger	19.71	1.16	-.0215	1.01	Exeter	24.04	.97	-.0458	1.92
All areas	20.16	1.58	.0288	2.78	Fowler	23.55	.48	.0462	.69
Muscat					Fresno	23.19	.98	.0900	2.26
Del Rey	26.09	2.98	-.0403	1.86	Kingsburg	24.23	1.38	.1146	.43
Fowler	24.87	1.34	-.0208	1.01	Livingston	23.36	.53	.0286	2.57
Fresno	27.08	5.34	-.1508	4.20	Reedley	23.61	1.49	.0331	3.87
Kingsburg	25.78	2.23	-.0398	5.61	Selma	23.43	.57	.0213	1.22
Parlier	25.09	1.35	.0040	.37	Snelling	23.21	1.24	.1233	4.69
Reedley	25.54	3.09	-.0202	2.34	Turlock	21.90	.80	.0089	.52
Selma	25.75	2.05	-.0457	3.81	Woodlake	24.45	1.32	-.0061	.39
Sanger	25.31	3.99	-.0201	1.05	Sanger	24.14	1.06	-.0035	.38
All areas	25.65	2.57	-.0321	8.22	All areas	23.68	1.42	.0165	3.79
10c Winery B, 1948									
Carignane					Palomino				
Exeter	22.79	1.80	.0532	2.04	Parlier	22.68	1.49	.0933	5.18
Fresno	24.28	1.77	.0399	2.69	Sanger	20.75	1.22	-.0308	1.08
Orosi	20.93	2.59	-.0506	.60	Snelling	21.43	.59	-.0172	.57
Sanger	22.47	2.09	.0766	5.57	All areas	21.45	2.65	.0257	1.711
Clovis	24.52	.85	-.0428	1.79	Grenache				
Del Rey	22.03	.64	.0416	1.99	Snelling	24.49	2.11	.5411	2.57
All areas	22.87	3.79	.0412	4.03	All areas	24.79	2.34	.0843	5.01
Ribier					Feher Szago				
Exeter	19.00	.51	.0171	.64	Sanger	20.52	6.22	-.6201	11.08
Reedley	19.82	1.10	.0364	1.71	Zinfandel				
Sanger	19.36	2.58	.0909	1.76	Reedley	22.02	2.11	.1140	3.21
All areas	19.42	1.85	.0260	2.57	Sanger	21.29	1.14	.0312	1.19

(Continued on next page.)

Table 10 continued.

Farm and area	Age	Area	Slope	Pay	Variety and area	Aver-age	Vari-ance	Slope	Pay
Granger	24.42	.67	-.0345	.57	Dimmick	20.25	.39	-.0127	1.43
Hensley	23.77	1.09	.0250	.11	Kimball	20.89	.93	-.0133	2.78
All areas	24.05	3.11	-.0218	.17	Hensley	20.61	2.32	-.0215	2.31
Fresno	23.42	1.02	-.0471	1.11	Lincoln	20.14	1.74	-.0[illegible]	[illegible]
Hensley	22.20	.78	.0969	6.73	Granger	21.34	1.21	-.0321	4.01
Granger	21.37	.52	.0799	.60	All areas	21.19	.5.08	-.0227	4.19
All areas	[illegible]	[illegible]	-.0224	1.23	Kimball	21.15	1.44	-.0615	2.[illegible]
Water	[illegible]								
Granger	18.71	1.16	-.0615	1.01	Fresno	21.04	.97	[illegible]	
All areas	[illegible]	[illegible]	[illegible]	[illegible]	Granger	[illegible]	[illegible]	[illegible]	
Unused					Fresno	23.19	.08	-.0000	2.20
Fresno	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Fresno	23.08	5.41	-.1508	1.20	Hensley	23.61	1.49	-.0431	3.42
[illegible]									
[illegible]									
Granger	25.31	3.99	-.0201	1.05	Granger	24.14	1.04	-.0006	.45
All [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]									
Unused	20.23	2.19	[illegible]						
Granger	23.47	2.02	[illegible]						
Clovis	24.52	.85	-.0168	1.75	Cromwell	[illegible]			
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
All areas	22.87	3.79	.0412	1.03	All areas	21.49	2.38	.0084	5.01
[illegible]					Weber Sandy				
Hensley	17.02	1.11	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Granger	19.36	2.58	.0209	1.16	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
All areas	19.42	1.65	.0260	2.37	Granger	21.[illegible]	[illegible]	[illegible]	[illegible]

(Continued on next page.)

Table 10 continued.

Variety and area	Season average	Variance	Slope	"t"	Variety and area	Season average	Variance	Slope	"t"
10c Winery B, 1948 (Continued)									
Alicante					Malaga				
Fowler	22.51	1.63	.0320	.81	Del Rey	22.20	1.13	-.0361	2.48
Fresno	23.55	4.79	.0729	2.48	Dinuba	21.65	1.23	.0264	2.87
Reedley	21.12	1.90	.0895	3.63	Exeter	21.81	2.14	.0180	.92
Sanger	22.15	3.05	.0541	2.31	Malvoisie				
Del Rey	23.34	3.01	.0270	.51	Sanger	22.46	2.58	.1528	2.67
All areas	22.27	4.57	.0900	9.89	Selma	24.74	.24	.0549	3.59
Sultana					All areas	23.49	3.81	.1307	7.40
Kingsburg	21.29	1.77	-.0386	1.05					
Reedley	20.99	.66	.0039	.18					
All areas	21.60	1.46	-.0085	1.04					
10d Winery B, 1949									
Mission					Alicante				
Parlier	26.58	.55	.3786	2.25	Del Rey	23.84	2.81	-.6145	1.73
Reedley	27.29	1.66	.0843	.87	Fresno	24.21	2.05	.0975	2.94
All areas	26.92	2.81	.1778	6.61	Reedley	24.06	3.68	.2361	9.99
Grenache					Sanger	23.71	2.58	-.0083	.21
Orosi	25.93	.32	-.0405	.71	Selma	20.38	2.62	.1452	4.98
All areas	26.14	1.00	.0539	1.79	Malaga				
Palomino					Clovis	24.10	1.73	.1575	4.10
Reedley	21.80	.38	-.1183	1.35	Del Rey	23.02	1.06	-.0043	.11
Sanger	22.85	.37	-.0454	1.02	Dinuba	23.64	3.86	.1678	5.45
Sultana					Exeter	23.19	1.67	.0999	4.47
Dinuba	23.01	2.80	.1931	3.26	Fresno	23.05	1.32	.0238	.70
Reedley	22.50	.71	.0177	.95	Kingsburg	23.10	1.17	.0033	.08
Sanger	23.00	1.77	-.0067	.14	Reedley	22.88	2.78	.0578	2.19
Thompson					Sanger	22.33	1.65	.0621	2.69
Dinuba	24.91	1.02	.0131	.30	Ribier				
Fresno	25.03	2.82	-.3076	5.11	Hanford	20.50	.49	-.4966	2.60
Reedley	24.97	.38	.0221	.70	Sanger	20.46	1.20	.0728	4.32
Sanger	24.98	1.14	.0331	.70	Muscat				
Selma	24.79	3.61	.1031	1.84	Clovis	26.85	.44	.0482	1.58
Carignane					Del Rey	27.63	.81	-.0928	2.19
Exeter	25.39	2.20	-.0455	.26	Dinuba	26.40	1.26	.0886	5.23
Fowler	23.52	1.57	-.0488	.83	Exeter	26.50	1.69	-.0251	.33
Fresno	25.44	6.06	.1052	1.02	Fowler	26.60	1.80	.1287	1.85
Reedley	23.82	1.18	.1083	3.34	Fresno	26.90	1.46	.0405	1.68
Sanger	23.21	2.18	.0399	1.46	Kingsburg	26.54	3.04	.1865	4.06
Emperor					Parlier	27.46	1.18	.0529	1.24
Dinuba	20.50	2.80	.0235	.87	Reedley	19.62	135.14	.8774	11.78
Exeter	20.78	.96	.0270	2.58	Sanger	26.52	1.63	.0587	2.71
Fresno	21.30	1.34	.1035	3.10	Selma	26.94	1.37	.0779	1.09
Reedley	20.95	2.06	.0367	1.27					
Sanger	21.59	1.57	.0998	4.59					
Selma	20.11	2.62	.0970	3.77					

(Continued on next page.)

Table 19 cont. ...

Table 10 continued.

Variety and area	Season average	Variance	Slope	"t"	Variety and area	Season average	Variance	Slope	"t"
10e Winery C, 1947									
Muscat					Palomino				
Clovis	23.90	1.49	.0598	.34	Fresno	21.96	6.94	.0755	1.52
Del Rey	24.12	2.59	.0767	1.71	All areas	21.69	5.25	-.0578	1.48
Fowler	23.63	1.18	.0447	1.33	Grenache				
Fresno	24.78	4.47	-.1126	6.15	Fresno	24.95	1.82	.0950	.85
Kingsburg	24.30	1.68	-.0715	3.70	All areas	24.86	1.73	.1033	.98
Parlier	23.73	2.29	-.0780	2.47	Alicante				
Reedley	24.13	2.68	-.0620	.57	Fresno	22.05	6.21	-.2010	6.54
Sanger	25.11	2.99	-.0636	1.10	All areas	22.20	4.37	-.0581	1.90
Selma	23.66	3.43	-.1266	4.59	Malaga				
All areas	24.16	3.24	-.0793	8.67	Caruthers	19.93	.64	-.0351	.48
Sultana					Clovis	20.97	2.67	-.0928	4.47
Fowler	21.11	1.08	-.0783	.40	Exeter	20.14	1.46	.2167	2.65
Fresno	20.77	1.54	-.0091	.61	Fresno	20.33	1.67	-.0103	1.10
Madera	22.14	1.62	-.3391	1.58	Ivanhoe	20.29	.94	.1057	2.57
All areas	20.94	1.47	.0958	13.23	Kerman	20.43	.94	.1986	3.56
Emperor					Kingsburg	19.99	1.85	-.0473	3.13
Exeter	18.43	2.00	-.0372	2.00	Madera	20.61	1.45	.0048	.21
Fresno	18.46	1.72	-.0266	2.01	Parlier	20.03	1.20	.0689	4.38
Ivanhoe	18.30	1.59	-.0043	.35	Reedley	19.00	1.72	-.0477	.91
Reedley	16.68	4.74	-.4304	5.46	Sanger	20.63	1.53	.0208	2.06
Sanger	18.44	2.90	.0137	.24	Selma	19.91	1.41	.0342	.79
Selma	18.28	1.90	.0167	.05	All areas	20.34	1.71	-.0130	2.59
Visalia	17.78	.86	-.0210	.86	Ribier				
All areas	18.30	1.90	-.0129	2.28	Fresno	20.04	.86	.0139	.65
Thompson					All areas	19.76	2.00	.0003	.02
Fresno	22.05	2.37	.0969	7.69	Carignane				
Selma	23.52	1.61	.0430	.84	Fresno	22.81	2.50	-.0911	2.88
All areas	22.33	2.48	.0424	3.80	Madera	22.14	.91	.0314	.49
Feher Szago					All areas	22.74	2.31	-.0732	2.79
Fresno	22.73	3.51	-.7187	3.62					
All areas	22.14	3.42	-.0289	1.32					
10f Winery C, 1948									
Malaga					Carignane				
Clovis	23.76	1.29	.0019	.17	Fresno	24.14	3.44	.0545	4.70
Del Rey	22.63	.41	.1447	1.90	Hanford	23.79	.91	.0913	1.20
Fresno	23.65	2.40	.0718	7.27	Kingsburg	23.29	.33	.0412	1.36
Kingsburg	23.40	.47	.0509	1.55	Turlock	22.66	1.44	.0670	.76
Modesto	23.75	.38	.1642	2.71	All areas	23.63	2.91	.0339	3.90
Parlier	23.00	.74	.0315	1.29	Grenache				
Sanger	23.31	1.56	.0781	12.56	Hanford	25.34	.86	-.0047	.21
Selma	22.96	.94	.0638	1.05	Turlock	28.05	.91	.2381	3.02
All areas	23.44	2.04	.0438	9.62	All areas	25.93	3.23	.0895	10.11

(Continued on next page.)

				Variety and area	Aver-age	Vari-ance	Score	Wt
				Palomino				
				Fresno	21.36	6.91	.0755	2.52
				All areas	21.46	[illegible]	-.0578	[illegible]
				Fresno				
				All areas				
				All areas	22.20	4.47	-.0501	1.70
				Mariana				
				Stanislaus	19.92	[illegible]	[illegible]	[illegible]
				[illegible]				
				[illegible]				
				[illegible]			

Table 10 continued.

Variety and area	Season average	Variance	Slope	"t"	Variety and area	Season average	Variance	Slope	"t"
10f Winery C, 1948 (Continued)									
Thompson					Muscat				
Caruthers	21.41	.29	.0767	1.32	Clovis	24.49	1.79	.0180	1.83
Clovis	23.70	.45	.0211	4.17	Del Rey	23.95	1.24	.0266	1.00
Del Rey	24.74	.64	-.0093	.51	Hanford	25.46	1.65	.0084	.38
Exeter	23.39	1.44	.0254	2.26	Kingsburg	24.41	1.33	.0164	2.53
Fowler	21.25	20.09	.0550	.32	Reedley	24.91	2.07	.1422	5.20
Fresno	22.86	1.28	.0266	5.90	Sanger	23.55	2.65	.0894	12.59
Hanford	23.24	1.30	.0014	.03	Selma	24.32	1.58	.0467	6.94
Ivanhoe	22.24	1.43	.0075	.51	All areas	24.34	116.38	.7204	140.41
Kerman	22.61	1.08	.2147	2.93	Sultana				
Kingsburg	22.15	.58	.0301	5.67	Clovis	23.27	1.21	.0308	2.54
Madera	22.60	.88	-.0001	.01	Del Rey	21.97	.56	.0494	2.91
Parlier	22.78	.32	.2541	1.80	Fresno	22.83	1.63	.0261	2.71
Reedley	22.27	.62	.0565	6.14	All areas	22.61	1.56	.0424	7.50
Sanger	22.60	1.99	.0595	4.25	Ribier				
Selma	22.91	.69	.0072	.54	Fowler	19.10	.90	.1504	1.70
All areas	22.76	1.83	.0243	8.02	Fresno	21.36	1.79	.2634	13.00
Zinfandel					Sanger	20.32	.39	.0103	.54
Clovis	25.18	4.08	.0138	.30	All areas	20.35	1.85	.0378	3.39
Fresno	25.02	3.83	.0051	.06	Tokay				
Lodi	24.15	4.18	.2230	1.92	Fresno	20.29	1.40	.1297	.66
Palomino					Lodi	20.54	1.19	.0698	3.75
Dinuba	21.65	1.18	-.1139	1.88	Ripon	21.29	.22	.0340	.81
Fresno	21.91	1.80	-.0168	.63	All areas	20.55	1.19	.0746	4.34
All areas	21.89	1.31	.0012	.09					
10g Winery C, 1949									
Muscat					Emperor				
Del Rey	26.95	3.51	.0585	.92	Clotho	22.62	2.43	-.1594	3.50
Fowler	26.76	2.10	.0867	3.81	Clovis	22.40	4.85	.1241	2.85
Kingsburg	26.84	1.55	.1056	8.36	Del Rey	23.19	.71	.0097	.11
Parlier	26.70	1.57	.0254	1.44	Exeter	21.50	2.00	.0283	1.53
Sanger	27.26	2.34	.0133	.40	Orange Cove	21.51	1.15	-.0865	3.72
Selma	27.30	1.48	.0731	3.63	Parlier	21.40	2.06	-.0995	1.16
Reedley	27.99	2.30	.0459	2.82	Sanger	22.58	1.64	.0894	1.48
Fresno	27.61	3.94	.1160	4.95	Selma	25.58	3.58	.6370	2.67
All areas	27.23	2.37	.0659	10.21	Reedley	21.44	1.48	.0847	1.75
Alicante					Fresno	22.84	2.93	.0976	4.48
Clovis	26.28	1.93	.1833	4.42	All areas	22.34	3.40	.0197	1.83
Modesto	24.47	2.62	.1025	1.45	Feher Szago				
Sanger	24.50	4.14	.2595	2.77	Clovis	25.06	1.21	.0120	.29
Selma	24.34	10.50	.2444	1.24	Kingsburg	24.51	1.79	.0027	.10
Turlock	24.02	3.14	.1102	.92	Sanger	26.24	3.32	.2550	1.75
Fresno	24.51	3.86	.0347	.73	Fresno	24.89	3.02	.0982	5.28
All areas	25.00	4.52	.0766	3.13	All areas	24.99	2.72	.0539	3.60

(Continued on next page.)

Table 10 continued.

Variety and area	Season average	Variance	Slope	"t"	Variety and area	Season average	Variance	Slope	"t"
10g Winery C, 1949 (Continued)									
Carignane					Thompson				
Clovis	25.19	.65	.0756	2.02	Biola	24.57	.78	.0481	.94
Exeter	25.95	1.67	.1279	1.56	Clotho	24.62	1.79	-.0245	.25
Hanford	24.61	1.37	.1446	2.53	Clovis	24.97	1.26	.0935	3.76
Ivanhoe	25.78	.22	-.0328	.47	Kingsburg	25.20	2.25	.0898	3.98
Kingsburg	25.15	2.82	.2064	8.55	Madera	25.31	4.48	.1179	4.20
Madera	26.10	.45	.0236	.93	Sanger	25.45	3.01	.0784	1.61
Modesto	25.22	2.41	.1060	3.35	Selma	25.00	1.21	.0088	.57
Sanger	25.53	2.19	.1358	5.46	Fresno	24.89	1.52	-.0352	2.12
Turlock	25.64	2.89	.1758	5.41	All areas	25.02	1.89	.0303	4.09
Reedley	25.54	.54	.0359	.48	Malaga				
Fresno	25.74	7.19	.3005	12.41	Clovis	24.70	1.55	.0356	1.64
All areas	25.36	7.49	.2164	13.70	Del Rey	24.55	1.34	.0560	2.30
Grenache					Exeter	23.79	2.95	.0140	.42
Clovis	25.49	1.14	.0084	.09	Fowler	24.56	1.12	.1609	2.26
Exeter	27.62	9.11	.2955	2.72	Kingsburg	24.76	1.96	.0341	2.31
Fowler	26.69	.40	.0359	1.65	Madera	26.25	3.70	.2758	6.88
Modesto	26.64	2.31	.2181	2.56	Orange Cove	24.98	.92	-.2420	3.69
Fresno	27.10	5.24	.1992	11.70	Parlier	24.28	3.24	.1652	5.30
All areas	27.08	5.12	.1791	12.53	Sanger	24.40	3.29	-.0315	1.72
Sultana					Selma	23.83	2.49	.1194	7.99
Clovis	22.98	1.63	-.0086	.17	Winton	25.01	6.76	.3582	7.62
Fowler	22.97	.94	.1365	2.32	Reedley	24.35	3.99	-.0708	1.75
Selma	23.16	4.41	.1473	2.78	Fresno	24.62	2.95	.0238	2.42
Fresno	24.02	1.09	.0509	3.47	All areas	24.55	3.07	.0329	5.84
Kingsburg	22.76	.73	-.0267	.39	Palomino				
All areas	23.48	3.39	.1160	9.12	Fresno	24.75	9.47	.0015	.06
					All areas	24.69	8.48	.0024	.12

The season average and the slope or average daily rate of change in sugar together suffice to determine the trend for each classification. Thus, Table 10a summarizes the findings for Winery A in 1947. In that year Petite Sirah grapes delivered to Winery A from Modesto registered season average sugar of 23.07 per cent. The variance was 1.6 per cent. On the average, there was a gain of sugar of .0856 per cent per day. This rate was highly significant statistically since the "t" value is 16.74. The season average for Petite Sirah received in 1947 by Winery A from all areas combined was 23.27 per cent with a somewhat smaller variance. The estimated rate of change in sugar was .0684, again highly significant statistically. Nearly all calculated daily average rates of change for particular varieties from particular areas were negative in that year. This was generally true of all the wineries although the rates differed significantly. Many of the slopes shown for the variety area classes in Table 10a are not considered statistically significant since the "t" values are frequently less than the magnitude of three which is conventionally considered to indicate an acceptable level of significance. Nonetheless, the general conclusions are apparent. Differences in means of given varieties vary among areas by as much as 1.5 per cent. The measures of dispersion are obviously different. Petite Sirah seems to have been a deviate from the downward trend in sugar generally in 1947. Other varieties drifted downward as the 1947 season progressed. Significant trends vary from about zero to a daily average decrease in sugar of about .1 per cent. It is clear that given minimum standards would have clearly different impact both on the percentage of varietal production eliminated by the several areas and on the timing of harvesting and crushing.

Similar data are shown in Table 10b to 10d for Winery B and in Tables 10e to 10g for Winery C in 1947-1949.

Tonnage Eliminated

Impact on Varieties.--In Figure 19, the percentage of receipts of each of the major varieties which would have been denied access to Winery C is shown for minimum sugar standards of 19, 20, 21, and 22 per cent. These estimates are made for each of the three years 1947-1949. In Figure 20, the percentages which would have been eliminated from deliveries to all varieties out of each of the major areas are shown, again for each of the years 1947-1949. Tables 11 and 12 indicate the percentages of each major variety which would have been eliminated by each of the specified minimum standards for Wineries C and B, respectively, for each one of the three years. Tables 13 and 14 summarize for Wineries B and C, respectively, the percentages which would have been eliminated in each of the years from the total deliveries from each of the major areas of origin. These percentages are calculated upon the assumption--implicit throughout this analysis--that sugar content patterns and harvesting procedures would not have been different in the three years had there been some sort of control over volume through specification of minimum sugar content as a condition for eligibility to deliver to wineries for crushing.

Analysis of any column in Table 11 will indicate how the different varieties delivered to Winery C would have been affected by the relevant minimum sugar percentage. Within any year comparison of the four columns will indicate how each of the varieties would be affected by changes in the minimum standards. Comparison with a similar column in Table 12 will indicate the differences in the impact of any particular minimum requirement in any one year as between the two wineries. Analysis of any row in Table 11 or Table 12 will indicate the differences over

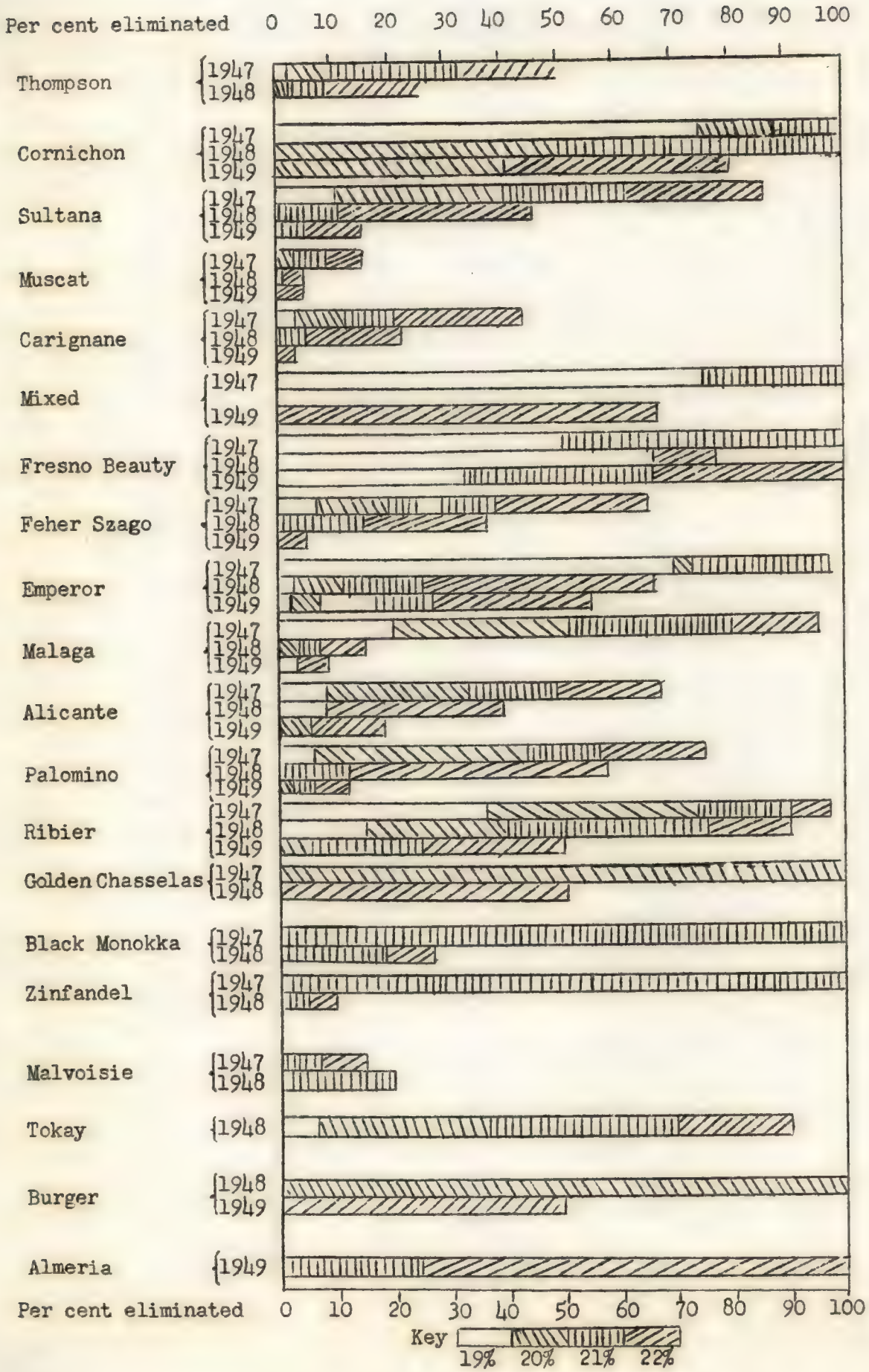


FIGURE 19

Estimated Percentage Eliminated by Various Minimum Sugar Requirements, by Varieties, Winery C, 1947-1949

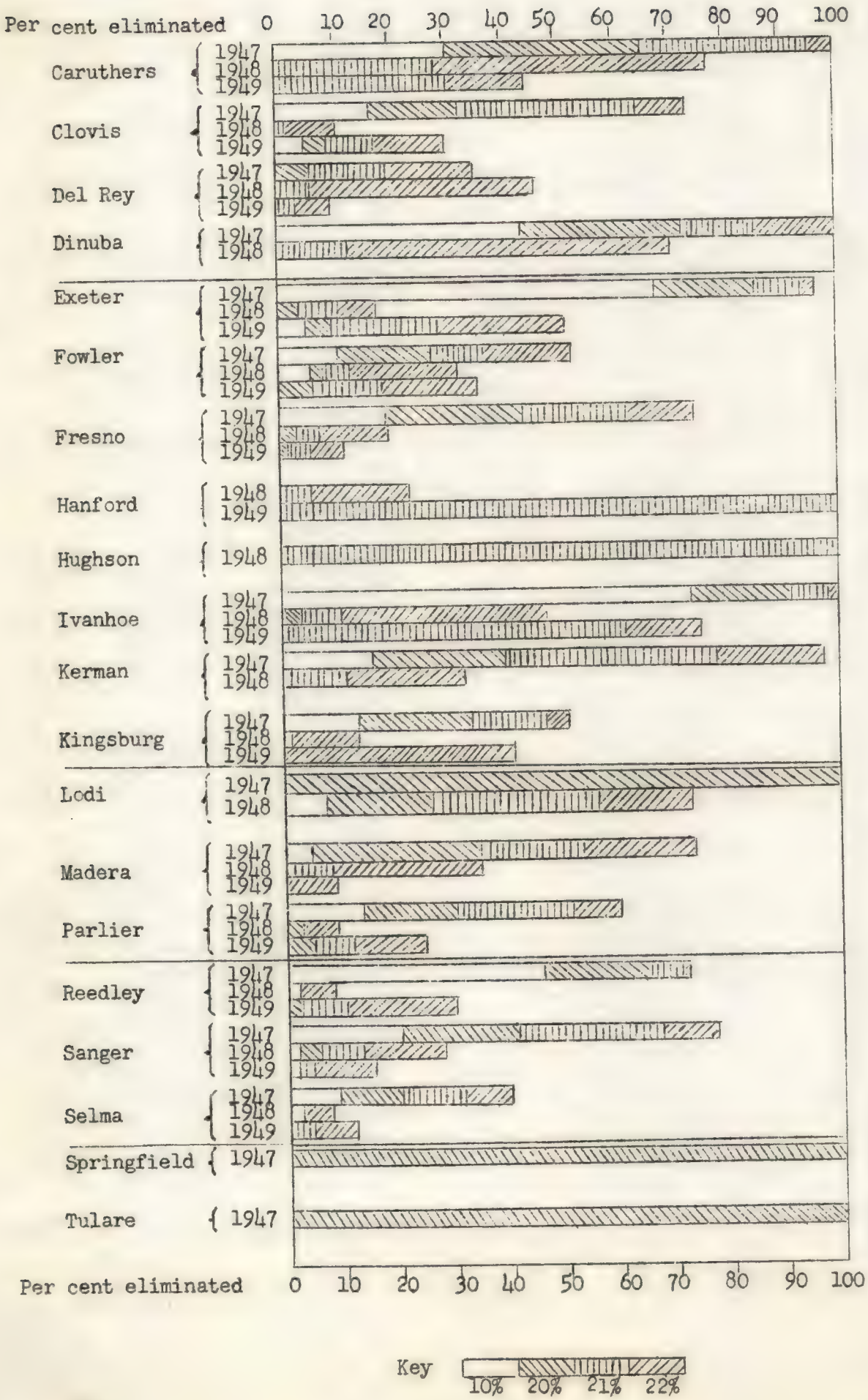


FIGURE 20

Estimated Percentage Eliminated by Various Minimum Sugar Requirements, All Varieties, by Areas of Origin, Winery C, 1947-1949

TABLE 11

Estimated Percentages of Loads Ineligible for Crushing Under Specified Minimum Sugar Requirements, by Varieties, Winery C, 1947-1949

Variety	1947				1948				1949			
	19	20	21	22	19	20	21	22	19	20	21	22
	per cent											
Thompson	2.3	10.6	32.6	50.8	.1	1.3	6.6	25.5	0	0	1.7	3.4
Cornichon	75.0	87.5	100.0	100.0	0	50.0	100.0	100.0	0	40.0	40.0	80.0
Sultana	10.6	38.7	63.4	86.7	0	1.0	10.8	43.1	0	0	3.4	15.1
Muscat	.2	2.6	8.6	14.9	0	0	.6	5.8	0	0	0	4.7
Carignane	3.0	10.8	21.6	43.3	0	0	4.0	23.5	0	0	.7	2.6
Mixed	75.0	75.0	100.0	100.0					0	0	0	66.7
Fresno Beauty	50.0	50.0	100.0	100.0	66.7	66.7	66.7	77.8	33.3	33.3	66.7	100.0
Feher Szago	6.3	18.7	37.4	62.5	0	0	14.7	35.3	0	0	0	5.8
Emperor	69.3	73.2	98.5	99.1	3.7	11.1	25.9	66.7	2.6	5.3	26.8	54.3
Malaga	19.7	51.0	79.5	94.2	.2	1.7	5.3	14.0	.2	.6	1.8	7.8
Alicante	7.4	33.3	48.2	66.7	0	0	7.7	38.5	0	4.0	4.0	18.0
Palomino	6.3	43.7	56.2	75.0	0	0	11.4	56.8	0	1.4	5.7	12.9
Ribier	36.9	73.9	89.1	97.9	14.0	39.5	74.4	90.7	0	4.2	25.4	49.3
Golden Chasselas	0	100.0	100.0	100.0	0	0	50.0	100.0				
Black Monukka	0	0	100.0	100.0	0	0	18.2	27.3				
Cull	0	0	100.0	100.0								
Zinfandel	0	0	100.0	100.0	1.5	1.5	4.5	10.6				
Malvoisie					0	0	6.7	13.3	0	0	16.7	16.7
Tokay					7.0	35.0	70.0	90.3				
Burger					0	100.0	100.0	100.0	0	0	0	50.0
Almeria									0	0	25.0	100.0
All varieties	22.6	40.1	61.6	72.6	.8	3.3	8.9	22.0	.3	1.0	4.7	12.5

TABLE 12

Estimated Percentages of Loads Ineligible for Crushing
Under Specified Minimum Sugar Requirements, by Varieties,
Winery B, 1947-1949

Variety	1947 Less than 19	1947 Less than 20	1947 Less than 21	1947 Less than 22	1948 Less than 19	1948 Less than 20	1948 Less than 21	1948 Less than 22	1949 Less than 19	1949 Less than 20	1949 Less than 21	1949 Less than 22
	per cent											
Muscat	0	.1	.8	2.3	.3	1.3	2.6	12.2				
Ribier	24.2	51.5	69.7	81.8	41.7	70.0	90.0	96.7	10.1	26.1	73.9	85.5
Thompson	0	.2	2.1	8.7	6.7	15.7	29.3	49.9	0	0	0	20.0
Zinfandel	100.0	100.0	100.0	100.0	3.1	9.4	40.6	75.0				
Semillon					0	0	25.0	75.0				
Alicante	1.6	3.0	10.2	32.4	3.6	12.4	32.8	59.1	1.4	6.3	9.2	17.6
Malaga	4.6	20.3	49.0	72.4	.6	5.6	15.6	43.2	0	.5	6.0	19.0
Feher Szago	10.8	24.6	41.5	67.7	29.4	47.0	52.9	64.7	0	0	0	100.0
Carignane	0	3.0	8.1	28.3	2.7	8.2	21.2	37.0	0	0	1.6	14.8
Sultana	3.9	7.8	31.1	49.5	3.2	9.5	32.6	69.5	0	0	3.3	28.9
Golden Chasselas					0	0	14.3	28.6				
Valdepena					0	0	0	50.0				
Emperor	68.2	86.4	90.9	90.9	20.0	45.0	57.5	82.5	9.0	28.3	59.1	83.5
Mixed	14.3	14.3	28.6	42.8	33.3	33.3	44.4	77.8	7.7	7.7	23.1	30.8
No variety	100.0	100.0	100.0	100.0	6.2	18.8	37.5	62.5				
Tokay	0	0	50.0	100.0	75.0	100.0	100.0	100.0				
Palomino	0	1.0	16.5	37.1	4.5	10.1	28.1	70.8	0	0	7.7	34.6
Almeria					0	0	0	100.0	0	100.0	100.0	100.0
Mourastal					0	12.5	75.0	100.0				
San Salvador	0	0	0	100.0	0	0	14.3	71.4				
Malvoisie	0	0	10.5	42.1	0	7.7	25.6	51.3				
Petite Sirah	0	0	3.7	14.8	0	0	50.0	100.0				
Olivette	100.0	100.0	100.0	100.0								
Mission	0	0	0	50.0					0	0	0	16.7
Cornichon	75.0	100.0	100.0	100.0					0	0	66.7	100.0
Fresno Beauty	100.0	100.0	100.0	100.0								
All varieties	2.06	4.69	10.80	20.04	4.53	10.81	21.23	39.68	2.22	6.93	15.87	25.29

TABLE 13

Estimated Percentages of Loads Ineligible for Crushing Under Specified Minimum Sugar Requirements, All Varieties, Wineries B and C Combined, 1947-1949

Year	Minimum percentage			
	19	20	21	22
1947	10.30	18.89	31.17	41.12
1948	2.81	7.35	15.54	31.53
1949	.97	3.09	8.63	17.00

time in the effect of a given minimum upon a given variety delivered to a given winery over two or more seasons. Comparison of any row in Table 11 with the similar row in Table 12 will indicate the differences over time in the effects of the minima upon a given variety delivered to different wineries over two or more seasons.

Thus, in 1947, a 19 per cent minimum would have resulted in eliminating from Winery C the following percentages of deliveries: Thompsons, 2.3; Cornichons, 75; Sultanas, 10.6; Muscats, .2; and Emperors, 69.3. A 20 per cent minimum would result in the following percentages of eliminations by varieties from the 1947 crush at Winery C: Thompsons, 10.6; Cornichons, 87.5; Sultanas, 38.7; Muscats, 2.6; and Emperors, 73.2. Thus, in any one year with any minimum, the percentage impact upon varieties would have differed greatly. A change of 1 per cent in the minimum would have greatly different effects upon elimination among varieties delivered to a given winery in the season.

Impact on Wineries.--In any year the effects of a given minimum upon given varieties delivered to different wineries would have been grossly dissimilar. Thus, a 22 per cent minimum in 1947 would have eliminated 50.8 per cent of the loads of Thompsons delivered to Winery C but only 8.7 per cent of the Thompsons delivered to Winery B. A 19 per cent minimum would have eliminated 24 per cent of the Ribiers at Winery B and 37 per cent at Winery C. But a 22 per cent minimum would have eliminated 82 per cent at Winery B and 98 per cent at Winery C. These same variations in percentages of the varieties eliminated are equally drastic in considering variation between the two wineries in either of the other two years. For both wineries in any year, changes of 1 per cent in the minimum would have resulted in widely different elimination percentages among the varieties.

The differences in effects over time are even more striking. A 19 per cent minimum would have had the following effects upon Thompsons: 51 per cent in 1947; 25 per cent in 1948; and 3.4 per cent in 1949. At Winery B the corresponding percentages would have been 0, 6.7, and 0. Thus, for either winery, the percentage of a given variety eliminated by a given standard would differ sharply in different years. The year-to-year differences would also vary sharply between wineries.

Estimated Percentages of Seeds Available for Germination
Tennessee Agricultural Experiment Station, Bulletin 123, December 1922
Districts B and C Combined, 1918-1919

of the maximum upon a given variety delivered to different wineries over two or

Thus, in 1917, a 10 per cent minimum would have resulted in eliminating
[illegible] suitable, 10%; Riesling, 5%; and Traminer, 60%. A 20 per cent minimum would
typical upon varieties would have differed greatly. A change of 1 per cent in the
minimum would have practically different effects upon elimination among varieties
delivered to a given winery in the season.

Limit of Elimination.--In any year the effects of a given minimum upon a given
variety delivered to different wineries would have been greatly diversified.
[illegible] some variations in percentages of the varieties eliminated are equally
true year to year. For both wineries in any year, changes of 1 per cent in the

The differences in effects over time are even more striking. [illegible]
minimum would have had the following effects upon shipments. [illegible]
specific percentages of a given variety eliminated be a different
[illegible] in different years. The year-to-year

The total tonnage eliminated by any minimum would differ over each of the three years for a given winery. In each year the percentages eliminated by a given minimum would differ between wineries. The differences over time would also differ among wineries. The weighted average percentages of elimination of all varieties by each of the four minima in each of the three years are shown in the bottom rows of Tables 11 and 12. Compare the impact of the minima upon elimination of total receipts by Wineries B and C, respectively, for 1947: 19 per cent, 22.6 versus 2.06 per cent of deliveries; 20 per cent, 40.1 versus 4.69; 21 per cent, 61.6 versus 10.80; and 22 per cent, 72.6 versus 20.04. Thus, in 1947--largely because of the relative weights of the different varieties--Winery C would have been required to deny entry to a far heavier percentage of deliveries than would have been required of Winery B. With a 20 per cent minimum standard, Winery C would have eliminated nearly ten times as much as Winery B. With a 21 per cent minimum, Winery C would have been required to eliminate nearly six times as much as Winery B.

Winery B would have been required to eliminate more heavily under any minimum standard in 1948 than in 1947. Winery C, which would have been gravely disadvantaged with respect to Winery B in 1947, would have been required to eliminate much less in 1948 than in 1947. Winery C would also have eliminated much less in 1948 than Winery B in that year. Again, in 1949 Winery C would have been called upon to eliminate significantly less than Winery B. The advantage to Winery B in 1947 would have been reversed in each of the next two seasons. In these three years, there would be significant differences in overall elimination among similarly situated wineries. There is no evidence that the elimination percentages are stable from one season to another with respect either to elimination by a single winery or the relative elimination percentages of several wineries.

There is greater stability over time in the elimination percentages associated with the various minimum sugar requirements when the tonnage of the two wineries is consolidated. Weighting the elimination percentages shown for all varieties in Tables 11 and 12 by the relative tonnages of Wineries B and C, the following percentages of consolidated tonnages would have been denied access to the crushers in each of the three years.

The aggregate elimination percentages from any one of the minima differ widely over the three years. In any one of the years, the change in elimination percentage consequent upon a change of 1 per cent in the minimum standard varies with the level of the minima from which the change is made. The effects of changes in the minimum standards would have been significantly different among the three years.

Impact on Areas.--The effects of each of the four minimum sugar requirements upon major producing areas in each of the three years are shown for Winery C in Table 14 and for Winery B in Table 15. Figure 20 is derived directly from Table 14. The following questions are engaged in each of the two tables. For a given winery in a given year, what percentage of deliveries from each of the areas of origin would be rejected under each of the minimum standards? How would elimination from each of the areas be affected by a change of 1 per cent in the minimum sugar requirement in any year? What are the differences between elimination percentages among areas in any year as a consequence of a given minimum sugar standard? What are the differences in the effects of a given minimum standard upon a given area delivering to a given winery over several years? Comparison of the two tables suggests answers to other questions: In

Theory B. With a 22 per cent minimum, theory C would have been required to eliminate nearly six times as much as Theory B.

Theory B would have been required to eliminate more heavily under any minimum than theory C, under any minimum less than 22 per cent. Theory C would have been required to eliminate much less in 1967 than in 1967, would also have eliminated much less in 1968 than in 1967. Theory C would also have eliminated less in 1968 than Theory B in that year. Again, in 1969 Theory C would have been called upon to eliminate significantly less than Theory B. The advantage to Theory B in 1967 would have been reversed in each of the next two years. In these three years, there would be significant differences in overall elimination among equally situated winners. There is no criterion that the elimination percentages are, strictly from one season to another with respect to eliminating winners, by a single theory or the relative elimination percentages of several theories.

There is greater stability over time in the eliminations pertaining exclusively to losers. Varying the eliminating percentages from season to season with the various minimum sugar requirements when the tonnage of losers was to be eliminated

TABLE 14

Estimated Percentages of Loads Ineligible for Crushing Under Specified Minimum Sugar Requirements, by Areas of Origin, Winery C, 1947-1949

Areas	Number of loads	1947				Number of loads	1948				Number of loads	1949			
		19	20	21	22		19	20	21	22		19	20	21	22
		per cent					per cent					per cent			
Caruthers	17	29.4	64.7	94.1	100.0	14	0	0	28.6	78.6					
Clotho											14	0	0	28.6	42.8
Clovis	81	16.0	30.9	63.0	71.6	240	.4	.8	1.7	10.0	103	4.9	7.8	16.5	31.1
Del Rey	32	0	3.1	18.8	34.4	20	0	0	5.0	45.0	44	0	0	2.3	9.1
Dinuba	7	42.8	71.4	85.7	100.0	24	0	0	12.5	70.8					
Exeter	77	66.2	85.7	93.5	96.1	83	0	2.4	9.6	16.7	104	3.8	7.7	26.9	51.0
Fowler	62	9.7	25.8	35.5	51.6	93	4.3	6.4	11.8	31.2	42	0	4.8	16.7	35.7
Fresno	902	18.8	42.8	61.8	73.4	110	.4	2.3	6.6	19.5	722	.1	1.0	4.8	11.8
Hanford						21	0	0	4.8	23.8		0	0	100.0	100.0
Herndon	4	50.0	100.0	100.0	100.0										
Hughson						1	0	0	50.0	100.0					
Ivanhoe	225	73.3	91.6	97.8	99.1	30	0	3.3	10.0	46.7	8	0	0	62.5	75.0
Kerman	31	16.1	38.7	77.4	96.8	9	0	0	11.1	33.3					
Kingsburg	199	13.1	33.2	44.7	51.2	440	0	.2	1.1	13.0	80	0	0	0	41.7
Lemoore						6	0	0	0	16.7					
Lodi	1	0	100.0	100.0	100.0	207	5.8	26.1	56.5	73.4					
Madera	102	4.9	34.3	52.9	72.5	85	1.2	2.4	7.0	35.3	43	0	0	0	9.3
Modesto						12	0	0	8.3	33.3					
Orange Cove												0	0	38.7	77.4
Parlier	141	13.5	29.8	51.1	59.6	143	.7	2.1	3.5	9.1	65	0	3.1	13.8	26.2
Reedley	48	45.8	64.6	70.8	72.9	79	0	0	1.3	7.6	51	0	2.0	9.8	29.4
Ripon						9	0	0	33.3	100.0					
Salida						4	0	0	50.0	75.0					
Sanger	234	19.2	41.9	67.1	86.3	410	1.5	4.9	13.9	27.6	170	0	0	2.9	15.3
Selma	167	8.4	19.8	31.7	40.1	392	0	0	1.0	6.9	118	0	0	4.2	11.9
Springfield	1	0	100.0	100.0	100.0										
Tulare	5	0	100.0	100.0	100.0										
Turlock						21	0	0	5.0	38.1					
Visalia	21	85.7	95.2	100.0	100.0										
Winton						4	0	0	0	25.0					
Weighted average		22.6	40.1	61.6	72.6		.8	3.3	8.9	22.0		.3	1.0	4.7	12.5

TABLE 15

Estimated Percentages of Loads Ineligible for Crushing Under Specified Minimum Sugar Requirements, by Areas of Origin, Winery B, 1947-1949

Areas	Number of loads	1947 Less than 19	1947 Less than 20	1947 Less than 21	1947 Less than 22	Number of loads	1948 Less than 19	1948 Less than 20	1948 Less than 21	1948 Less than 22	Number of loads	1949 Less than 19	1949 Less than 20	1949 Less than 21	1949 Less than 22
		per cent					per cent					per cent			
Clovis						46	0	0	6.5	17.4	20	0	0	10.0	20.0
Cutler	3	100.0	100.0	100.0	100.0										
Denair	3	33.3	33.3	33.3	66.7										
Del Rey	45	0	2.2	15.6	22.2	215	1.4	4.6	10.7	27.0		0	0	0	23.1
Dinuba	71	1.4	14.1	33.8	46.5	246	11.0	23.6	42.7	60.2	109	8.2	26.6	44.0	60.6
Exeter	7	14.3	28.6	57.1	85.7	156	7.7	17.9	30.8	57.0	140	4.3	20.0	50.7	44.3
Fowler	3	0	0	66.7	66.7	161	1.2	3.1	14.3	29.2	10	20.0	20.0	30.0	70.0
Fresno	93	0	1.1	1.1	15.1	198	2.5	4.5	7.6	22.7	94	1.1	7.4	18.1	34.0
Hanford	1	0	0	100.0	100.0	47	2.1	4.2	10.6	34.0		8.3	16.7	83.3	100.0
Ivanhoe	2	0	0	0	50.0										
Kingsburg	377	0	1.6	5.0	10.3	106	5.7	12.3	25.5	53.8	42	0	0	11.9	28.6
Orange Cove	3	66.7	100.0	100.0	100.0	33	6.1	12.1	15.2	27.3		50.0	50.0	100.0	100.0
Lindsay						53	1.9	5.7	7.5	24.5		100.0	100.0	100.0	100.0
Livingston	117	0	0	0	5.1	161	0	.6	2.5	10.6					
Madera						35	17.1	28.6	45.7	71.4					
Manteca	40	5.0	10.0	17.5	32.5		0	0	14.3	71.4					
Monmouth						2	0	0	0	50.0					
Orosi	10	10.0	10.0	10.0	30.0	122	4.9	13.1	29.5	45.1	5	0	0	20.0	60.0
Navelencia						38	47.4	78.9	86.8	100.0					
Parlier	77	3.9	3.9	11.7	11.7	148	1.4	3.4	12.2	24.3	9	22.2	44.4	100.0	100.0
Reedley	1,144	1.7	5.6	12.2	24.6	653	2.6	10.7	23.7	41.8	218	2.3	8.1	22.9	42.2
Sanger	465	2.8	5.4	14.0	26.0	610	3.4	9.3	17.9	39.8	259	1.5	3.5	16.2	31.7
Selma	48	10.4	14.6	29.2	33.3	266	13.2	23.7	37.2	55.6	40	22.5	57.5	82.5	87.5
Snelling	96	0	1.0	5.2	13.5	145	0	6.2	29.7	70.3	7	0	28.6	85.7	100.0
Sultana						11	18.2	18.2	45.4	72.7	4	0	0	50.0	75.0
Turlock	26	0	0	19.2	53.8										
Woodlake	20	10.0	35.0	60.0	95.0										
Weighted average		2.06	4.69	10.80	20.04		4.53	10.81	21.23	39.68		2.22	6.93	15.87	25.29

TABLE 51

Estimated Percentage of Adult Females on Various Feed Rations

any given year, what is the difference in elimination from given areas of origin as a result of delivery to different wineries? In any year, what are the relative effects of a change of 1 per cent in the minimum standard upon elimination of loads from the same area delivered to different wineries? How do the relative elimination percentages for the two wineries from given minimum standards change over time?

The gross differences in percentages of elimination among different areas delivering to one winery, as a consequence of any given minimum sugar specification, are exemplified in the first column for 1947 in Table 14. A minimum standard of 19 per cent sugar would have meant the following elimination percentages by areas: Clovis, 16; Exeter, 66; Fresno, 19; Ivanhoe, 73; Madera, 5; Reedley, 46; and Visalia, 86. The same gross differences appear if other levels of minimum sugar are considered. Such disparities among area elimination percentages appear in all of the years. The differences are equally drastic for both wineries. It is doubtful that administration of a program involving such wide differences in elimination burdens among areas could easily be operated. Without special consideration provisions to equalize the area percentages, litigation would be probable. However, with equally wide differences in the impact of elimination upon varietal classes, formulation of special consideration provisions would be virtually equivalent to setting some reasonably uniform percentage of elimination applicable to all areas or varieties.

A change of 1 per cent in the level of the minimum sugar requirement in any one of the years would have sharply different effects upon different areas delivering to the same winery. To increase the 1947 standard from 19 to 20 per cent sugar content would have affected the elimination percentages of several of the areas as follows: Fresno from 19 per cent to 43 per cent elimination; Del Rey from 0 to 3; Madera from 5 to 34; and Fowler from 10 to 26. The same gross and unequal changes in elimination percentages among areas would have existed among deliveries to Winery C in 1948 and 1949. In 1948 an increase in the minimum level from 21 to 22 per cent sugar content would have raised the elimination percentage for Caruthers from 28.6 to 78.6 per cent of deliveries. The same change would have increased the elimination percentage for Reedley from 1.3 to 7.6 per cent. Similar disparities would have occurred between areas which delivered to Winery B.

The total elimination by the two wineries would have differed drastically in any one of the three years. Winery C would have eliminated much more heavily than Winery B in 1947. The reverse situation would have prevailed in 1948 and in 1949. These same conclusions are clearly applicable to the areas of origin. There is no stability over time in the percentages of elimination imposed upon the various areas as a function of any specified minimum standard. In any one of the years, any one of the minimum sugar standards would have resulted in concentration of the elimination of particular varieties by Winery C in particular areas of production. In 1947 Winery C would have eliminated much more heavily than Winery B in consequence of any one of the four levels of the minimum sugar standard. The reverse situation would have prevailed in 1948 and 1949. As examples of the areal concentration of elimination in particular varieties, Winery C received Thompsons from six areas in 1947. At minimum levels of 19 and 20 per cent, all of the elimination would have been concentrated in grapes from Fresno. Of 43 loads of Thompsons denied entry to the winery at 21° sugar, 41 would have originated in Fresno; at 22° sugar, 67 loads in total would have been eliminated with 61 from Fresno. Fresno origins would have been hit hardest in 1948, particularly at low levels of sugar. In this

any given year, what is the difference in eliminations from given reasons, origin as a result of delivery to different warehouses? In any year, what are the relative effects of a change of 1 per cent in the minimum standard upon eliminations of loads from the same area delivered to different warehouses? How do the relative eliminations movements for the two wineries from given minimum standards change over time?

The gross differences in percentages of elimination among different areas delivering to one winery, as a consequence of any given minimum sugar specification, are examplified in the first column for 1917 in Table 1. A minimum standard of 19 per cent sugar would have meant the following elimination percentages by areas: Delta, 4%; Sierra, 6%; Pacific, 8%; Inland, 11%; Coastal, 14%; Bayside, 16%; Foothill, 19%; Valley, 24%; Northern, 27%; Redding, 30%; Mountain, 36%; Desert, 40%; Lake, 45%; and Tuscola, 50%. The same gross differences appear if other levels of minimum sugar are considered. Such disparities among areas eliminating percentages appear in all of the years. The differences are equally dramatic for such wineries. It is doubtful that administration of a program involving such differences in elimination murders among areas could easily be operated without special consideration provisions to equalize tree-area percentages. Litigation would be probable. However, with equally wide differences an the treatment of eliminations upon varietal classes, formulation of special considerations involving relatively equivalent to getting some reasonably uniform percentages of elimination applicable to all areas or varieties.

A change of 1 per cent in the level of the minimum sugar requirement in any one of the years would have sharply different effects upon different areas delivering to the same winery. To increase the 1917 standard from 19 to 20 per cent sugar content would have affected the elimination percentages of several of the areas as follows: Fresno from 5% to 11 per cent eliminations; Delta from 0 to 1; Madera from 5 to 11; and Fowler from 10 to 26. The same gross and unequal changes in eliminations percentages among areas would have existed for deliveries to Winery C in 1918 and 1919. In 1918 an increase in the minimum level from 21 to 22 per cent sugar content would have raised the elimination percentage for Centerboro from 28.6 to 36.6 per cent of deliveries. The same change would have increased the elimination percentage for Roadby from 5.3 to 11.5 per cent. Similar disparities would have occurred between areas when delivered to Winery B.

The total elimination by the two wineries would have differed substantially in any one of the three years. Winery C would have eliminated much more than Winery B in 1917. The reverse situation would have prevailed in 1918 and in 1919. Some short-run implications are briefly considered for the years of 1917 and 1918. There is no stability over time in the percentages of eliminations imposed upon the various areas as a function of any specified minimum standard. In any one of the years, any one of the minimum sugar standards would have resulted in substantially different eliminations. The choice of a particular standard for elimination of varieties or areas of production, in fact, if Winery C would have eliminated much more frequently than Winery B in accordance of any one of the four levels of the minimum sugar standard. The reverse situation would prevail in 1919. An examination of the areal elimination of eliminations in particular varieties, Winery C received Thompsons from six areas in 1917. At minimum levels of 19 and 20 per cent, all of the eliminations would have been confined to the Thompsons delivered to the Delta and Tuscola. If the Thompsons delivered to the winery at 21% sugar, all would have originated in Delivery #2 Roadby. If total would have been eliminated with all from Fresno. Fresno originally would have been high harvest in 1918, particularly at low levels of sugar. In this

year, however, another difficulty of the minimum sugar proposal was apparent. An increase in the minimum sugar level from 20° to 21° would have quadrupled the elimination of Thompsons from Sanger. An increase from 21° to 22° would have increased the elimination from Madera, Selma, and Kingsburg by more than tenfold. There would have been drastic changes in elimination of Thompsons from other areas. In 1949 only negligible quantities of Thompsons delivered to Winery C would have been denied winery access by any of the four minima considered. Thus, consideration of particular varieties from particular areas sent to a given winery in a single year leads to the same conclusions reached from consideration of the all variety or all area classifications. In any year, elimination may be concentrated in particular areas in an apparently haphazard pattern. Small changes in the standards lead to large changes in elimination, and again the distribution of elimination is generally concentrated in a few areas. From one year to another, application of the same minimum standards results in widely different total elimination and distribution thereof.

The Fresno area would have been generally disadvantaged with respect to many varieties delivered to Winery C in 1947. Sanger and Selma would have been hurt in Muscats in both 1947 and 1948. Sultanas and Muscats would have been eliminated heavily in those years but virtually unaffected in 1949. Emperors would have been virtually kept out of the winery in 1947. Visalia, Sanger, Exeter, Fresno, Ivanhoe, Selma, and Reedley would have been nearly closed off by a 19° minimum. This same variety and mainly the same areas would have been adversely affected in 1949.

Malagas would have been affected in 1947 much like Emperors with heavy elimination concentrated in a few areas. Unlike Emperors, Malagas would not have been especially affected in 1948 or 1949. Palominos would have been hit hardest in 1948 with Dinuba eliminating most of this variety denied access to Winery C. Ribiers would have been eliminated much more heavily in 1947 and 1948 than in 1949, although in both of the former years the distribution of elimination would have been fairly general. Culls would have been most seriously affected in 1948 with little elimination in either 1947 or 1949.

With respect to particular varieties from particular areas, there appears to be little stability in elimination percentages from one season to another. In any season elimination of particular varieties tends to concentrate in particular areas. But the concentration pattern is not stable over time. For most varieties the change in tonnage eliminated by a change of 1° in minimum sugar requirements is abrupt and unstable as between areas and over time.

These conclusions appear to be supported: it is virtually impossible presently to predict the tonnage of grapes which would be eliminated from wineries in any year by any minimum standard of sugar; it is impossible to predict the distribution of tonnage actually eliminated among varieties, areas of origin, and receiving wineries. There is no stability over time in the relative impact of a given minimum standard upon areas, varieties, or receiving wineries. The total elimination as well as its distribution would differ drastically--and unpredictably--from one season to another. There is no way to predict the change in the total tonnage eliminated as a result of a small change in the minimum standard. Differences in impact upon areas, varieties, and wineries are such that effective administration appears almost impossible.

year, however, another difficulty of the method [illegible]. An increase in the minimum sugar level from 20° to 21° would have quite [illegible] the elimination of Thompsons from Delvera, Solma, and Kingsburg by more than a hundredfold. There would have been drastic changes in elimination of Thompsons from other areas. In 1965 only negligible quantities of Thompsons delivered [illegible] achieved. Thus, consideration of particular varieties from particular areas [illegible] sent to a given winery in a single year leads to the same conclusions reached from consideration of the all varietal or all area classifications. In any year, elimination may be concentrated in particular areas in an apparently haphazard pattern. Small changes in the standards lead to large changes in elimination, and again the elastic action of elimination is generally concentrated in small areas. From one year to another, application of the same minimum standards results in [illegible].

The Fresno area would have been generally disadvantaged with respect to many varieties delivered to Winery C in 1967. Sanger and Selma would have been [illegible] in both 1967 and 1968. Sultanas and Muscats would [illegible] eliminated heavily in those years but virtually unaffected in 1969. Thompsons would have been [illegible] kept out of the winery in 1967. Visalia, Dinuba, Exeter, Fresno, Reedley, Selma, and Hanford would have been [illegible] by a 10° minimum. This same variety and nearly the same areas would have been severely affected in 1968.

Malagas would have been [illegible] in 1967 much like Thompsons with heavy elimination concentrated in a few areas. Unlike Thompsons, Malagas would not have been especially affected in 1968 or 1969. Palominos would have met hardest in 1969 with Dinuba eliminating much of this variety destined for Winery C. Reserves would have been eliminated much more heavily in 1967 and 1968 than in 1969 although in both of the former years the distribution of elimination would have been fairly general. Golfs would have been most seriously affected in 1968 with little elimination in either 1967 or 1969.

With respect to particular varieties from particular areas, there appears to be little stability in elimination percentages from one season to another. In any season elimination of particular varieties tends to concentrate in particular areas. [illegible] varieties tends to eliminate the change in tonnage eliminated by a change of 1° in minimum sugar requirements is almost and unstable as between areas and over time.

These conclusions appear to be supported: it is virtually impossible prearbitrarily to predict the tonnage of grapes which would be eliminated from varieties in any year by any minimum standard of sugar; it is impossible to predict the distribution of tonnage partially eliminated among varieties, areas of origin, and seniority of vines. There is no stability over time in the relative tonnage of a given minimum standard upon areas, varieties, or receiving wineries. The total elimination as well as the distribution would differ drastically--both unpredictably--from one season to another. There is no way to predict the change in the total tonnage eliminated as a result of a small change in the minimum standard. Differences in impact upon areas, varieties, and wineries are such that effective communication appears almost impossible.

Harvesting and crushing operations would be capriciously affected by minimum sugar standards. In some years there would be general closing dates, in others there would be opening dates as a consequence of minimum sugar control. In all years there would be unsystematic differences in impact upon different varieties, areas of origin, and receiving wineries.

Other quality standards than minimum sugar could, of course, be used. The effects of such standards can be appraised only by obtaining data which when properly analyzed will yield answers to the kinds of questions engaged here with respect to the minimum sugar content proposal.

Opening and Closing Dates

It has been noted above that the specification of sugar minima would in fact sometimes apply opening and closing dates to the crushing operations of wineries. However, these side effects of minimum sugar requirements would have little system. In years of negative intraseasonal trends, closing dates would be imposed but with drastic differences among varieties, areas of origin, and wineries. With rising intraseasonal trends, as in 1948, the same discriminatory effects would appear in this indirect determination of opening dates. There have been frequent suggestions of explicit opening and closing dates for crushing. Figures 21 and 22 indicate some of the effects of such a proposal in 1947.

Impact on Varieties.--In Figure 21 there are two panels for each variety. In the left-hand panel, each bar indicates the cumulated percentage of tonnage crushed by Winery B up to the indicated date. Thus, for Alicantes, Winery B had received a little more than 75 per cent of the tonnage delivered in the 1947 season by the week ending October 11. The right-hand panel bars for each variety are cumulated from the end of the season backwards to the week ending October 25. It is thus shown that the imposition of a closing date of October 25 would have eliminated about 20 per cent of the Alicantes delivered to Winery B in 1947 on the assumption that deliveries would not have been accelerated as a result of announcing the closing date.

The differences in the effects of opening dates upon the varieties are obvious from inspection of Figure 21.[34] A September 20 opening date in 1947 would have excluded from crushing by Winery B about 20 per cent of the Alicante less than 10 per cent of the Malaga, a few Carignane, and no Mission grapes. The effect upon Feher Szago, Ribier, Grenache, and Thompson grapes would have been severe. Such a date would have been almost fatal to the Zinfandel, Fresno Beauty, Golden Chasselas, and Petite Sirah grapes. These conclusions, of course, assume that the same pattern of delivery would prevail after the announcement of the opening dates. The wide differences in effect of opening dates upon the several varieties are parelleled by similar effects of closing dates. An October 25 closing date would have eliminated most of the Emperor grapes actually crushed. Muscat, Ribier, and San Salvador grapes would have been affected seriously.

34/ Palomino grapes appeared to be erratic with respect to mean harvest dates over the three seasons. However, when other varieties were ranked according to mean (or median) date of harvest in each season, the following correlations were obtained by Pearson's method of rank correlation: 1947 and 1948, .76; 1948 and 1949, .65; and 1947 and 1949, .91. These coefficients of rank correlation were statistically significant. Most of the variation in rankings was attributable to Zinfandel and Palomino grapes.

Testing and Closing Dates.

It has been noted above that the elimination of super mixing would in fact sometimes simply operate and closing dates to the crushing operations of varieties. However, these data effects or minimum super requirements would have little system. In years of negative intercensoral trends, closing dates would be lowered but with drastic differences among varieties, areas of origin, and classes. With rising intercensoral trends, as in 1919, the same discriminatory effects would appear in their indirect determination of opening dates. There have been frequent suggestions of explicit opening and closing dates for crushing. Figures 21 and 22 illustrate some of the effects of such a proposal in 1919.

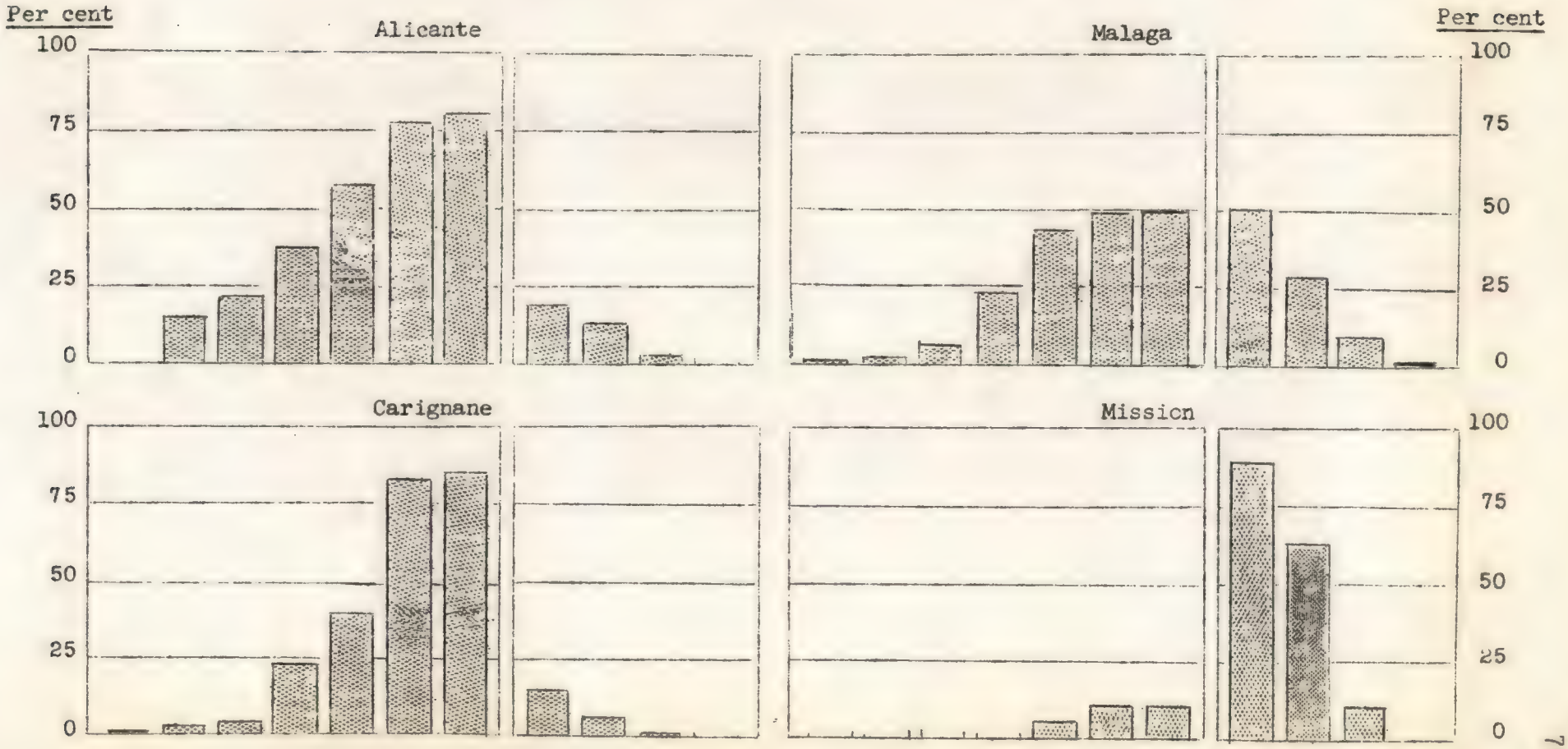
et on Varieties.--In Figure 21 there are two panels for each variety. In-Store period, each bar indicates the cumulated percentage of tonnage crushed by Plenary B up to the indicated dates. Thus, for Alicantes, Plenary B and received a little more than 75 per cent of the tonnage delivered in the 1919 season by the week ending October 11. The right-hand panel bars for each variety are constructed from the end of the season back to the week ending October 25. It is thus shown that the imposition of a closing date of October 25 would have eliminated about 20 per cent of the Alicantes delivered to Plenary B in 1919, the assumption that deliveries would not have been accelerated as a result of announcing the closing date.

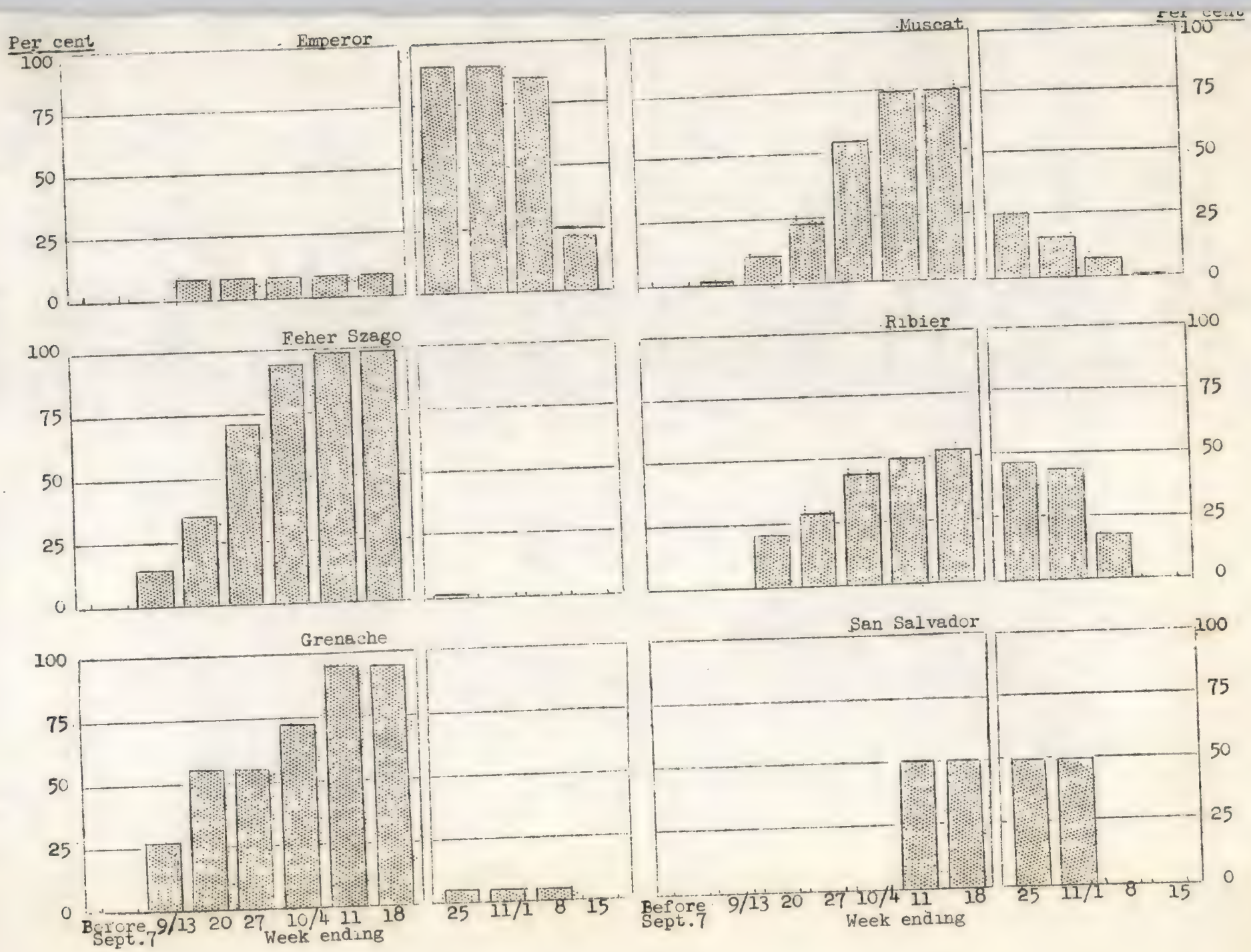
Figure from superposition of Figures 21 and 22. A September 25 opening date in 1919 would have excluded from crushing by Plenary B about 20 per cent of the Alicantes, less than 10 per cent of the Muscats, a few Currants, and no Zinfandel grapes. The effect upon Plenary Rubier, Granache, and Thompson would have been [illegible] Petition Commission, and resulted [illegible] These conclusions, of course, assume that the same pattern of delivery would prevail after the announcement of the opening date. The wide differences in effect of opening dates upon the several varieties are paralleled by similar effects of closing dates. An October 25 closing date would have eliminated most of the Emperor grapes actually crushed, almost, Ribier, and San Salvador grapes would have been affected seriously.

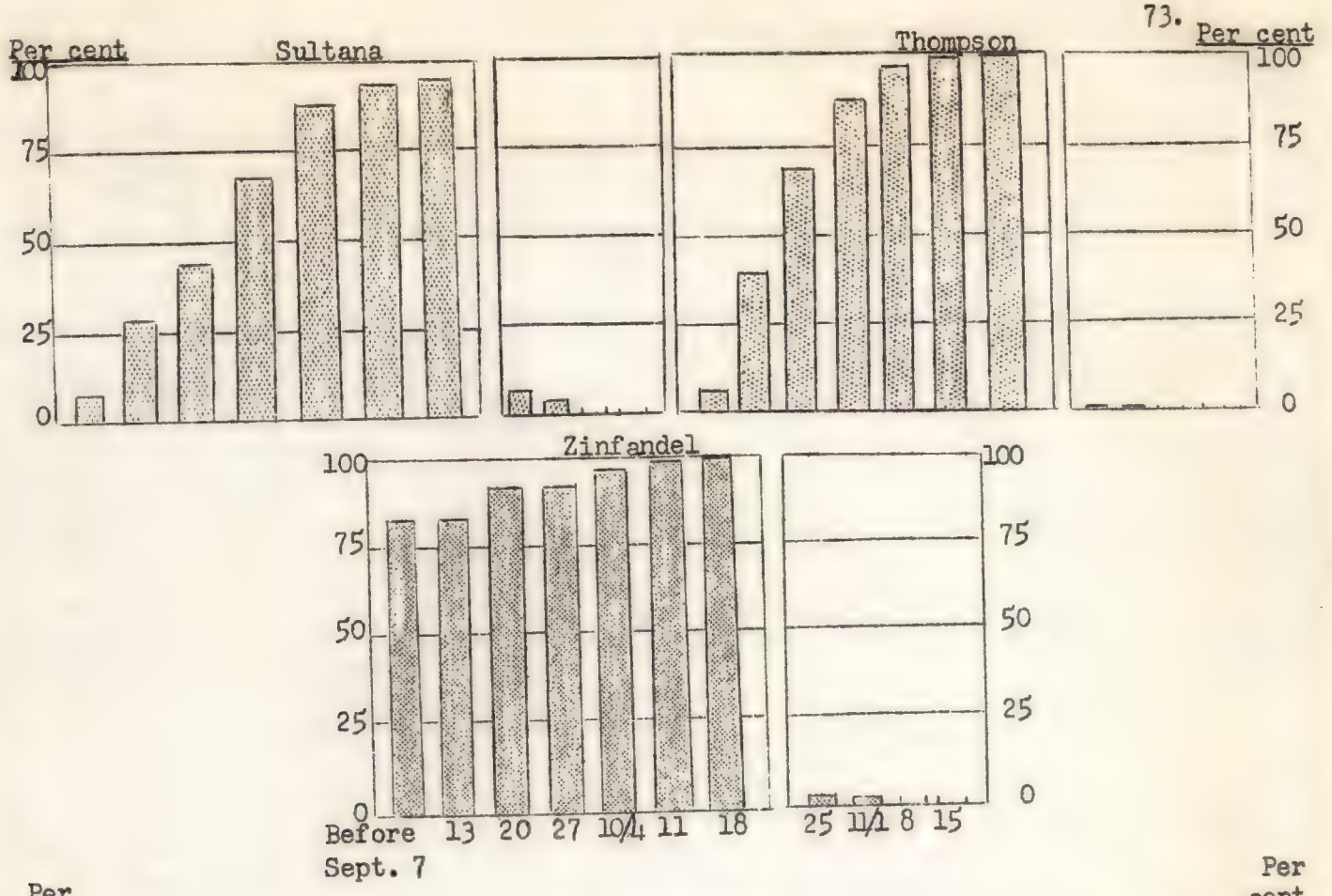
1/ Palomino grapes appeared to be erratic with respect to mean harvest dates; over the three seasons. However, when other varieties were ranked according to mean (or median) date of harvest in each season, the following correlations were obtained by Pearson's method of rank correlations: 1917 and 1918, .76; 1918 and 1919, .65; and 1917 and 1919, .91. These coefficients of rank correlation were statistically significant. Most of the variation in ranking was attributable to Zinfandel and Palomino grapes.

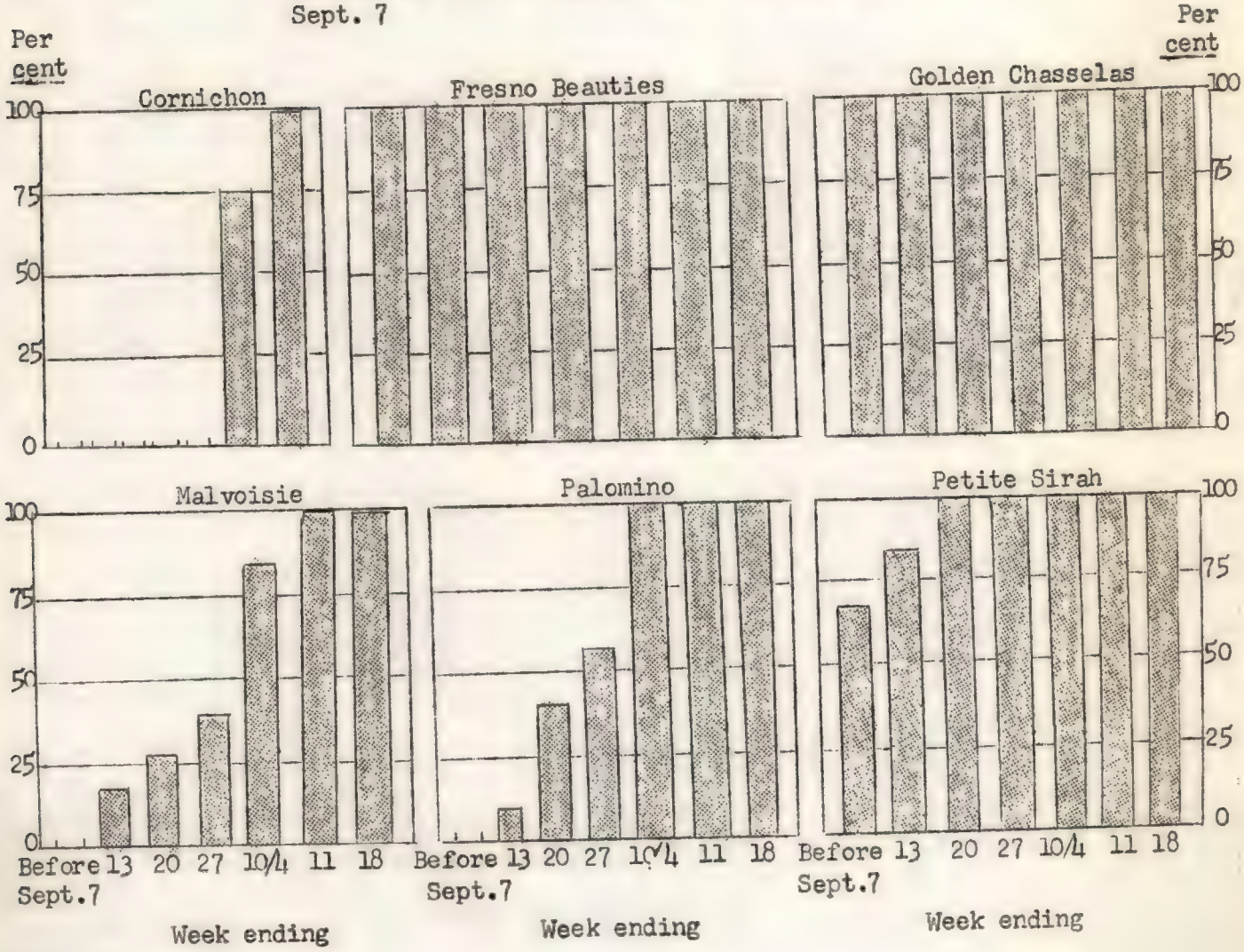
FIGURE 21

Percentage Distribution of Weekly Deliveries to Winery B, Cumulated from Beginning of Crushing Forward to Week Ending October 18, and from End of Crushing Back to Week Ending October 25, by Varieties, 1947




Per cent
Emperor
Muscat
Feher Szago
Ribier
Grenache
San Salvador
100
75
50
25
0
Before Sept.7
9/13
20
27
10/4
11
18
25
11/1
8
15
Week ending


Per cent
Sultana
Thompson
Per cent
100
75
50
25
0
Zinfandel
Before Sept. 7
13
20
27
10/4
11
18
25
11/1
8
15


Per cent
Cornichon
Fresno Beauties
Golden Chasselas
Per cent
Malvoisie
Palomino
Petite Sirah
100
75
50
25
0
Before Sept.7
13
20
27
10/4
11
18
Week ending

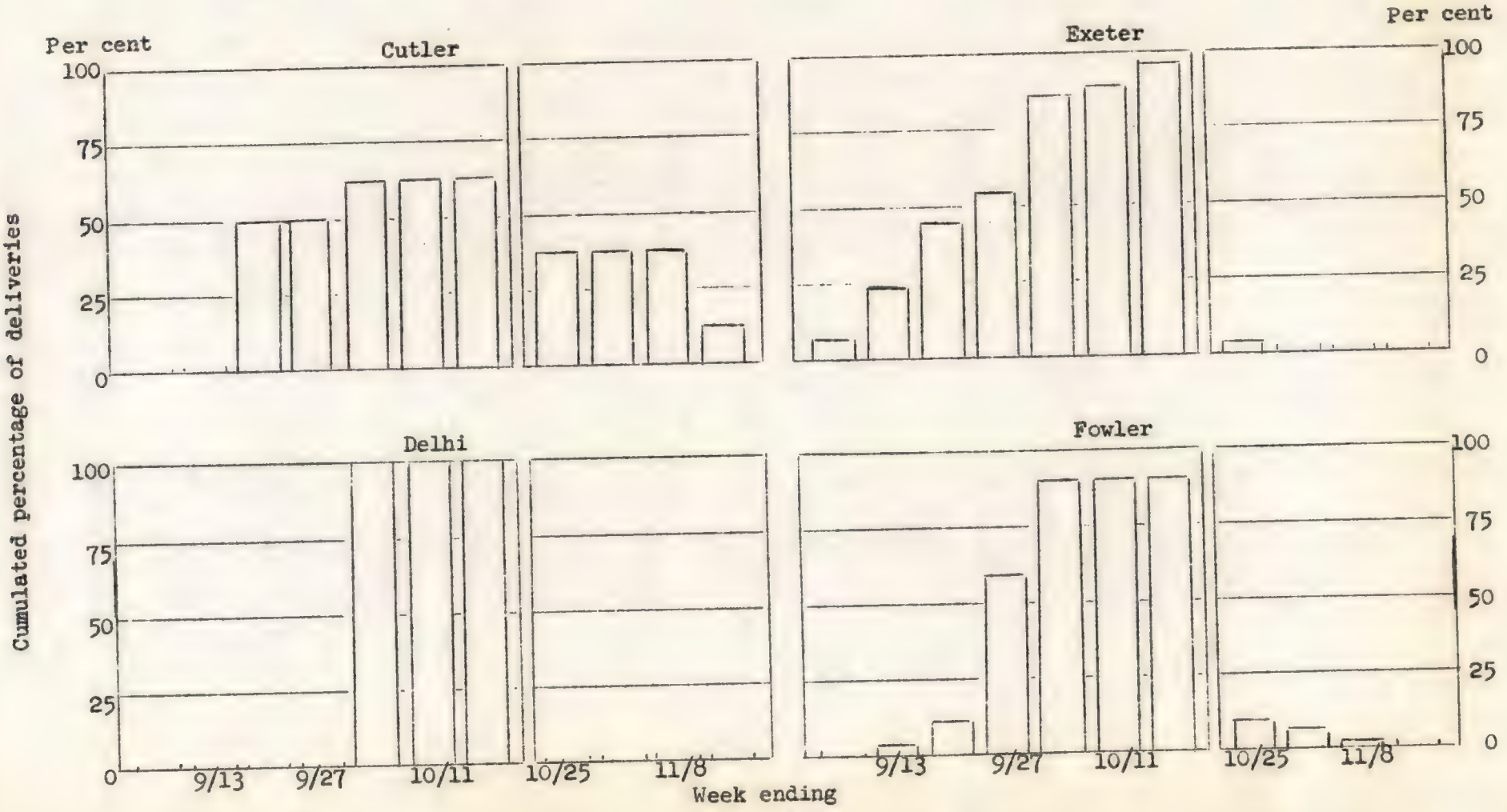
Sultana, Thompson, Zinfandel, Cornichon, Fresno Beauty, Golden Chasselas, Malvoisie, Palomino, and Petite Sirah grapes would have been unaffected. Winery C would not have crushed any grapes of the Black Prince, Olivette, Rose of Peru, or Tokay varieties at all in 1947 with an October 25 closing date. The effects of closing dates would therefore vary quite as widely among varieties as would those of opening dates.

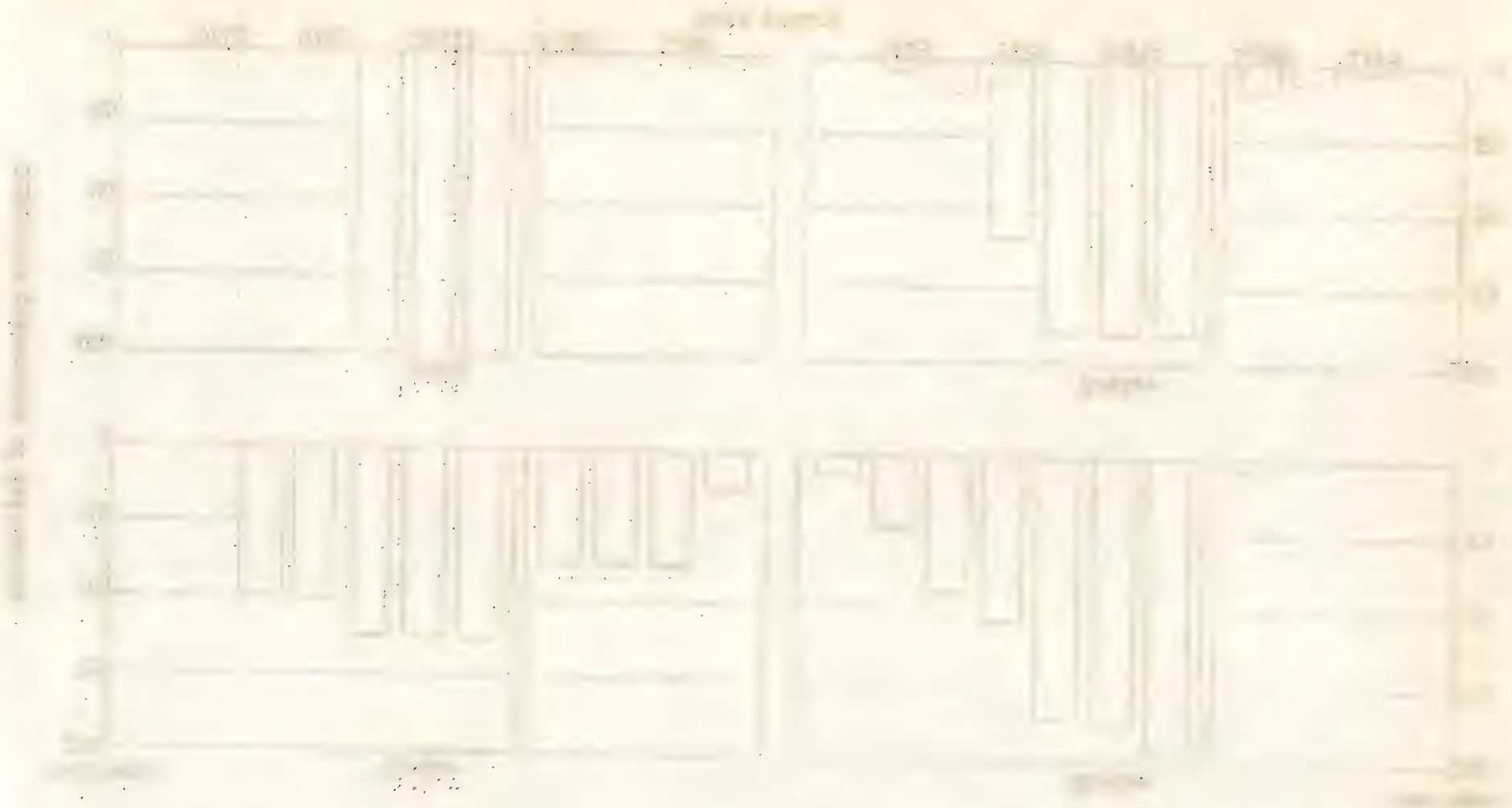
Impact on Areas.--Figure 22 is set up like Figure 21 except that deliveries are classified by areas of origin rather than by varieties. The same results appear. Opening dates would leave unaffected such areas as Delhi, Denair, Del Rey, Hanford, Ivanhoe, Laton, Le Grande, and Stockton. There would be elimination by such areas as Exeter, Fresno, Dinuba, Kingsburg, Orosi, and Livingston. Increase of sugar minimum by 1 per cent would in some cases eliminate the total crop of some areas and varieties. The same erratic effect is apparent from 1947 data with respect to opening dates. A September 20 opening would have little effect on some areas. A September 27 opening would seriously affect the same areas of origin. It appears to be quite as difficult equitably to control volume by changes in opening dates as to control by sugar minima. The effects of a closing date would also be centered on various areas. Among these would have been Denair, Del Rey, Hanford, Ivanhoe, and Parlier. Either opening or closing dates offer a fairly practicable technique for limiting total crush among all areas and varieties. The last panel in Figure 22 indicates a smooth cumulated distribution in either direction. However, the erratic distribution of elimination among areas and varieties would probably render this technique unsuitable for large-scale administration.

The effects of closing or opening dates would differently affect areas of production in any year. The effect on any area of origin would differ from one season to another. The total impact upon the operations of any receiving winery would be different from one season to another. The percentage of the total deliveries from each of more than twenty areas of origin to one winery is shown in Appendix Table X for the three years 1947-1949. The weeks at which deliveries commence in any year differ among areas. The percentages of total seasonal deliveries originating from individual areas in any week also differ. The percentage of total deliveries which would have been denied access to the winery through any specified opening or closing date would differ sharply among areas in any year. For all areas combined, the imposition of any particular closing date would have affected individual wineries quite differently over the three years.

FIGURE 22a

Percentage Distribution of Weekly Deliveries to Winery B, Cumulated From the Beginning of Crushing Forward to Week Ending October 18 and From End of Crushing Back to Week Ending October 25, by Areas, 1947





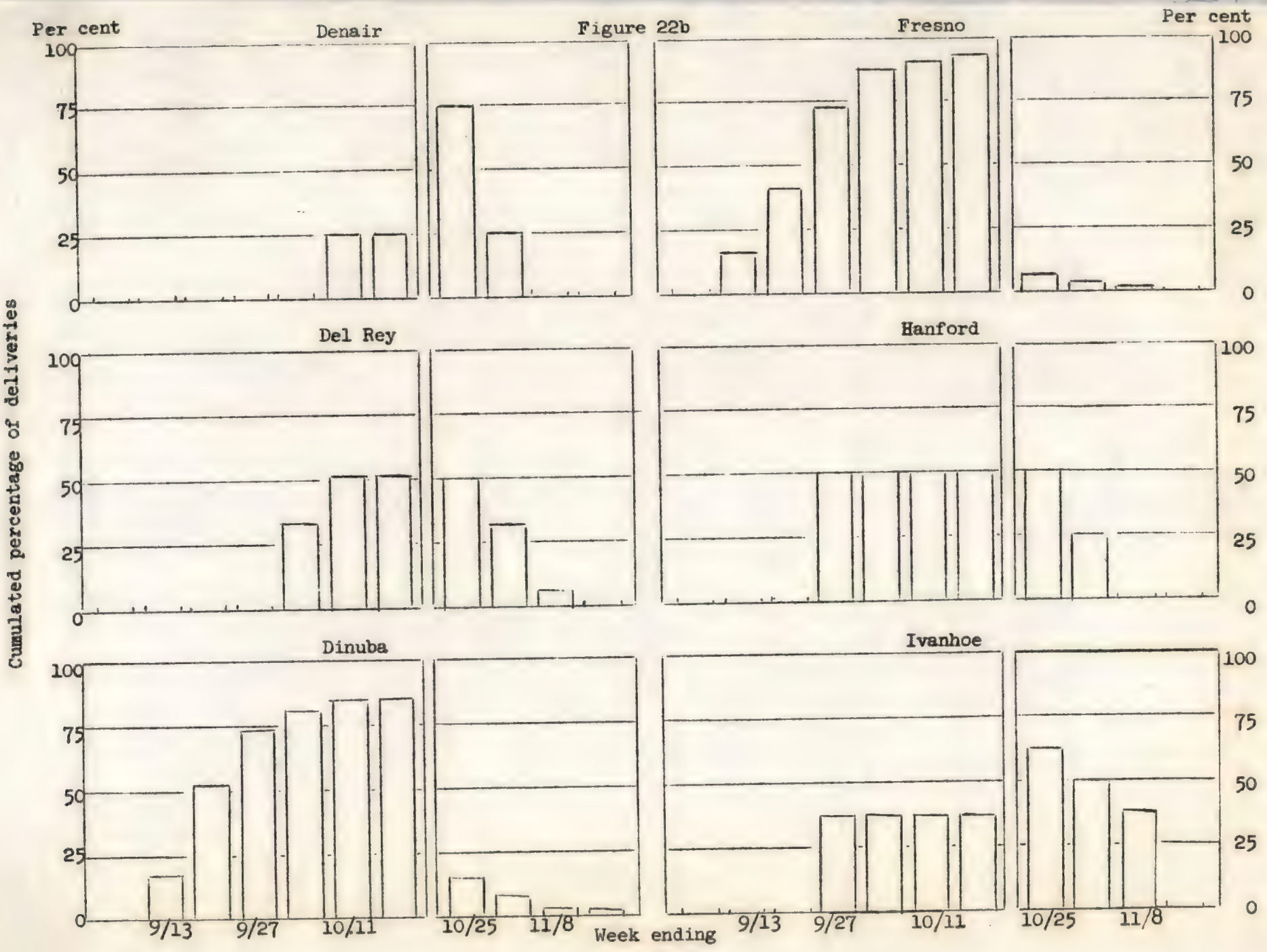
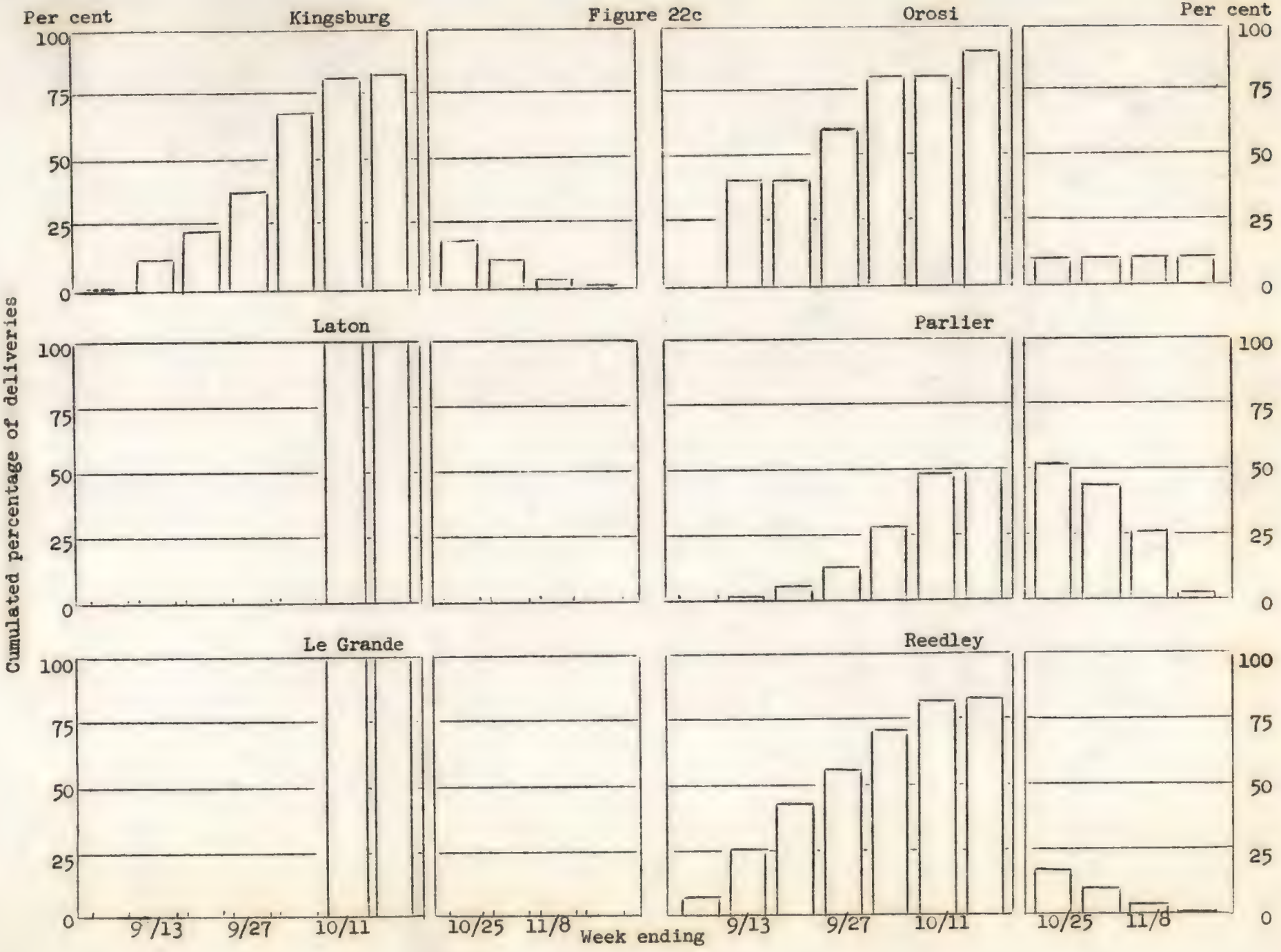
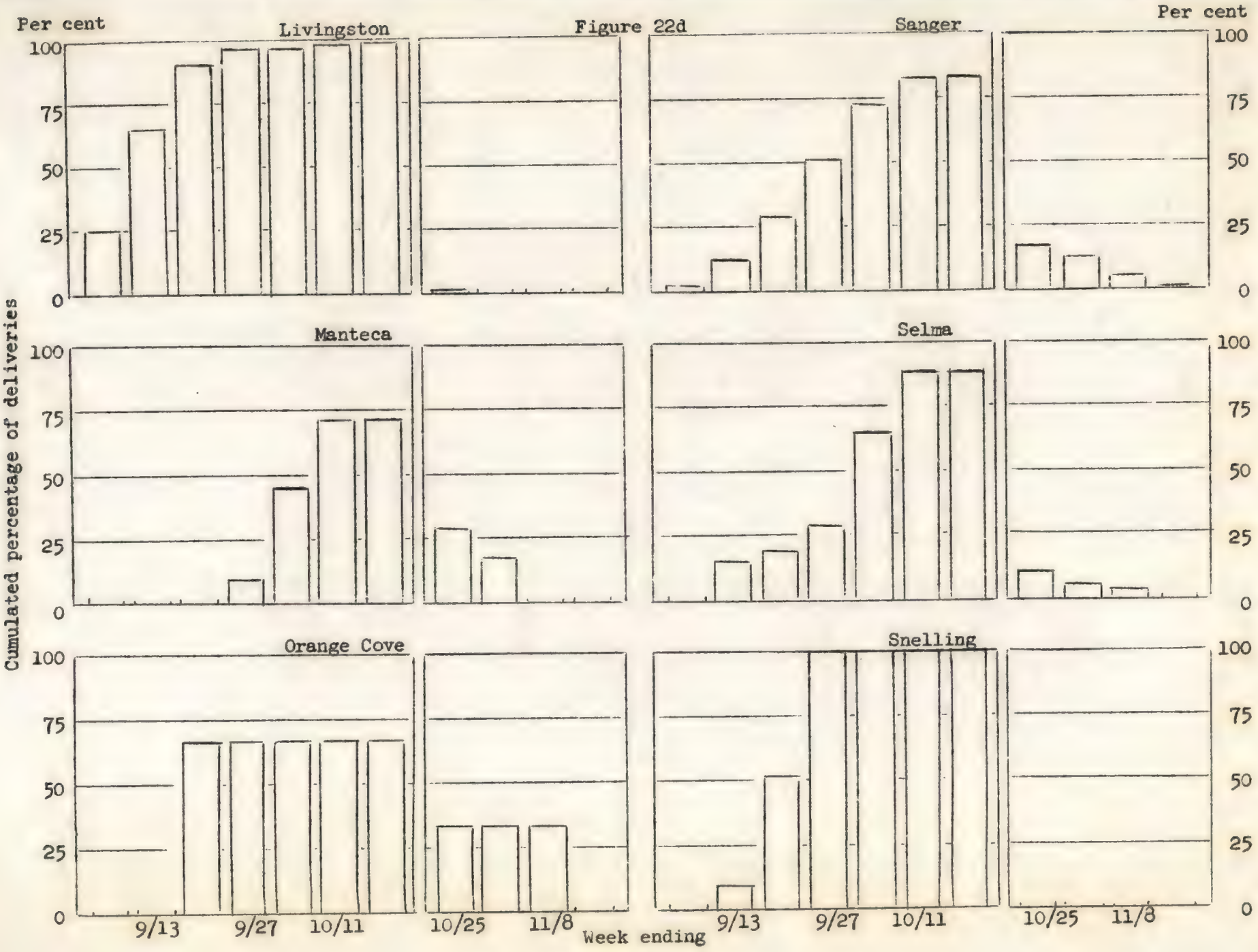


Figure 22b
Per cent
Denair
Fresno
Per cent
Del Rey
Hanford
Dinuba
Ivanhoe
100
75
50
25
0
Cumulated percentage of deliveries
9/13
9/27
10/11
10/25
11/8
Week ending

Figure 22c


Per cent
Kingsburg
Orosi
Per cent
100
75
50
25
0
Laton
Parlier
Le Grande
Reedley
Cumulated percentage of deliveries
9/13
9/27
10/11
10/25
11/8
Week ending


Per cent
Livingston
Figure 22d
Sanger
Per cent
100
75
50
25
0
Manteca
Selma
Orange Cove
Snelling
Cumulated percentage of deliveries
9/13
9/27
10/11
10/25
11/8
Week ending

APPENDIX TABIE I

Tonnage and Origins of Grapes Delivered to Wineries A, B, C, and D, 1947-1949

County and town	1947	1948	1949
Fresno			
Biola	156	183	184
Bowles	9		
Caruthers	156	129	
Clotho		28	350
Clovis	1,500	3,468	2,971
Del Rey	1,178	2,595	1,582
Fowler	1,831	3,073	2,576
Fresno	12,935	21,361	12,452
Herndon	46		276
Kerman	313	138	83
Kingsburg	6,366	6,164	4,950
Laton	46		46
Mendota		9	
Monmouth		120	74
Navelencia		359	
Orange Cove	506	432	506
Parlier	2,162	3,330	2,539
Reedley	8,620	10,175	4,057
Sanger	7,627	10,746	7,829
Selma	3,698	6,698	4,296
County total	47,149	69,008	44,771
Kings			
Armona		9	340
Hanford	83	1,150	616
Lemoore		156	
County total	83	1,315	956
Tulare			
Cutler	83	83	
Dinuba	1,297	3,790	2,300
Earlimart	221		
Exeter	837	1,674	2,787
Ivanhoe	2,125	1,260	170
Lindsay		488	18
Orosi	212	1,398	294
Porterville	9		
Springville	9		
Sultana	9	193	110
Terra Bella			55
Tulare	83		37
Visalia	405	129	37
Woodlake	975	18	
County total	6,265	9,033	5,808
Merced			
Atwater	552	248	
Cressey		37	
Delhi	46	331	
La Grande	18		
Livingston	1,812	2,392	552
Merced		28	18
Snelling	920	1,260	478
Winton	129	202	166
County total	3,477	4,498	1,214
San Bernardino			
Kingston	9		
County total	9		
San Joaquin			
Escalon		83	
Lodi	46	1,932	46
Manteca	368	175	
Ripon		83	9
Stockton	28	64	
Youngstown	37		
County total	479	2,337	55
Santa Clara			
Evergreen	64		
San Martin		110	
County total	64	110	
Stanislaus			
Ceres	138	9	9
Denair	55	28	
Hughson		46	37
Keyes	64		
Modesto	2,742	3,110	1,095
Salida	18	83	
Turlock	1,776	1,095	451
Waterford	9		
County total	4,802	4,371	1,592
Kern			
Delano	368		699
County total	368		699
Madera			
Madera	1,132	1,213	966
Minturn		46	
County total	1,132	1,259	966
Total	63,828	91,931	56,061

APPENDIX TABLE II

Tests of the Significance of Improvement of Fit by Introduction of Successive Terms, Based on Daily Averages of Sugar Content of Muscat Grapes, Winery D, 1947-48

Source of variation	Degrees of freedom	Sum of squares	Mean square	F
1947				
Total, ΣY^2	30	122.72		
Correction for mean	1	102.31		
Deviations from mean	29	20.41		
Linear regression	1	6.48	6.48	13.03[a/]
Deviations from linear regression	28	13.93	.50	
Second degree term	1	5.83	5.83	19.46[a/]
Deviations from quadratic regression	27	8.10	.30	
Third degree term	1	.17	.17	.56
Deviations from third degree regression	26	7.93	.30	
1948				
Total, ΣY^2	51	480.52		
Correction for mean	1	453.02		
Deviations from mean	50	127.50		
Linear regression	1	35.69	35.69	19.09[a/]
Deviations from linear regression	49	91.81	1.87	
Second degree term	1	1.61	1.61	.86
Deviations from quadratic regression	48	90.20	1.88	

a/ Highly significant.

APPENDIX TABLE III

Tests of the Significance of Improvement of Fit by Introduction of Successive Terms, Based on Daily Averages of Sugar Content of Thompson Grapes, Winery D, 1947-1949

Source of variation	Degrees of freedom	Sum of squares	Mean square	F
1947				
Total, ΣY^2	18	247.27		
Correction for mean	1	242.73		
Deviations from mean	17	4.54		
Linear regression	1	.46	.46	1.8039
Deviations from linear regression	16	4.08	.255	
1948				
Total, ΣY^2	49	433.02		
Correction for mean	1	420.83		
Deviations from mean	48	12.19		
Linear regression	1	6.66	6.66	56.4[a/]
Deviations from linear regression	47	5.53	.118	
Second degree term	1	.29	.29	2.5
Deviations from quadratic regression	46	5.24	.114	
1949				
Total, ΣY^2	24	120.82		
Correction for mean	1	100.04		
Deviations from mean	23	20.78		
Linear regression	1	.14	.14	.15
Deviations from linear regression	22	20.64	.93	

a/ Highly significant.

APPENDIX TABLE IV

Chi-Square Tests of Significance of Differences Among Means, by Varieties and Wineries, 1947-1949

Varieties	Years	Winery	χ^2 value
All	1947, 1948, 1949	B	451.64
All	1947, 1948, 1949	C	3,360.26
Malaga	1947	A, B, C	83.91
Carignane	1947	A, B, C	48.74
All	1947	A, B, C	1,017.17
Thompson	1947, 1948, 1949	B	1,325.93
Malaga	1947, 1948, 1949	B	267.30
Muscat	1947, 1948, 1949	B	952.84
Carignane	1947, 1948, 1949	B	36.54
Thompson	1947, 1948, 1949	C	1,515.76
Malaga	1947, 1948, 1949	C	3,541.81
Muscat	1947, 1948, 1949	C	1,144.52
Carignane	1947, 1948, 1949	C	118.00
Thompson	1947	A, B, C	570.74
Thompson	1949	A, B, C	290.71

APPENDIX TABLE V

Tests of Significance of Differences Among Means, by Varieties and Years, Winery B and Winery C, 1948-49

Varieties	Year	Number of loads		"t" value[a/]
		Winery B	Winery C	
All	1948	3,663	3,752	8.75
All	1949	1,845	3,631	15.89
Thompson	1948	1,462	1,043	16.47
Malaga	1948	349	433	38.51
Malaga	1949	230	752	35.18
Muscat	1948	984	1,381	5.46
Muscat	1949	561	909	22.86
Carignane	1948	217	176	4.13
Carignane	1949	129	334	5.65

a/ All of the calculated "t" values are significant. The test involves no assumption about the variances.

APPENDIX TABLE V

Chi-Square Tests of Significance of Differences Among means, by Varieties and Seasons, 1947-1949

Location	Years	Groups	Chi-Square
[illegible]	1947, 1948, 1949	B	[illegible]
[illegible]	1947, 1948, 1949	C	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	1947	A, B, C	[illegible]
Thompson	1947, 1948, 1949	B	[illegible]
[illegible]	1947, 1948, 1949	B	[illegible]
[illegible]	1947, 1948, 1949	B	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	1947, 1948, 1949	C	[illegible]
[illegible]	1947, 1948, 1949	C	[illegible]
[illegible]	1947, 1948, 1949	C	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	1947, 1948, 1949	C	[illegible]
[illegible]	1947	A, B, C	[illegible]
[illegible]	1949	A, B, C	[illegible]

APPENDIX TABLE VI

Tests of Significance of Differences Among Means, by Varieties and Years, Winery 1 and Winery 2, 1948-49

Variety	Winery 1	Winery 2	Chi-Square
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]

involve no assumption about the variances.

APPENDIX TABIE VI

Spearman's Coefficients of Rank Correlation
by Varieties, Wineries B and C, 1947-1949

Grape varietal ranks compared	Spearman's coefficient of rank correlation	Number of observations	Probability[a/]
Winery B			
1947 versus 1948	.791	13	.002
1947 versus 1949	.769	13	.002
1948 versus 1949	.709	13	.006
Winery C			
1947 versus 1948	.661	10	.032
1947 versus 1949	.855	10	.002
1948 versus 1949	.806	10	.004
Winery B versus winery C			
1947	.764	10	.006
1948	.885	10	.004
1949	.731	10	.010

a/ Student's "t" distribution was employed to interpret the probability of chance occurrence.

APPENDIX TABLE VII

Chi-Square Tests of Significance of Differences Among Means and Variances from Samples with Unequal Variances by Varieties, Areas, and Years, 1947-1949

Areas	Varieties	Years	Winery	χ^2 values--differences among	
				Means	Variances
1	2	3	4	5	6
Sanger	Muscat	1947, 1948, 1949	B	224.887[a]	18.459[a]
Sanger	Thompson	1947, 1948, 1949	B	285.129[a]	18.844[a]
Sanger	Malaga	1947, 1948, 1949	B	34.574[a]	2.874
Dinuba	Muscat	1947, 1948, 1949	B	207.279[a]	.773
Dinuba	Thompson	1947, 1948, 1949	B	169.056[a]	28.597[a]
Dinuba	Malaga	1947, 1948, 1949	B	73.397[a]	8.883[b]
Reedley	Muscat	1947, 1948, 1949	B	106.145[a]	65.745[a]
Reedley	Thompson	1947, 1948, 1949	B	307.911[a]	20.123[a]
Reedley	Malaga	1947, 1948, 1949	B	68.392[a]	3.473
Fresno	Muscat	1947, 1948, 1949	B	168.793[a]	2.567
Fresno	Thompson	1947, 1948, 1949	B	27.764[a]	2.114
Fresno	Malaga	1947, 1948, 1949	B	[c]	1.545
Kingsburg	Muscat	1947, 1948, 1949	B	80.962[a]	9.603[a]
Kingsburg	Thompson	1947, 1948, 1949	B	70.392[a]	4.448
Kingsburg	Malaga	1947, 1948, 1949	B	45.617[a]	5.759
Sanger	[d]	1947	B	196.470[e]	45.902[a]
Sanger	[d]	1948	B	152.419[a]	1.201
Sanger	[d]	1949	B	235.376[a]	.693
Dinuba	[d]	1947	B	339.218[a]	7.300[b]
Dinuba	[d]	1948	B	53.081[a]	18.578[a]
Dinuba	[d]	1949	B	67.421[a]	2.954
Reedley	[d]	1947	B	502.699[a]	39.272[a]
Reedley	[d]	1948	B	169.624[a]	2.365
Reedley	[d]	1949	B	65.002[a]	48.322[a]
Fresno	[d]	1947	B	[e]	6.717[a]
Fresno	[d]	1948	B	160.207[a]	4.731
Fresno	[d]	1949	B	37.725[a]	1.011
Kingsburg	[d]	1947	B	402.205[a]	9.744[a]
Kingsburg	[d]	1948	B	76.183[a]	19.504[a]
Kingsburg	[d]	1949	B	116.529[a]	5.853
[f]	All	1947	C	6,050.390[a]	20.544[a]
[f]	All	1948	C	17.642[a]	15.693[a]
[f]	All	1949	C	90.947[a]	46.544[a]
Clovis	All	1947, 1948, 1949	C	12.565[a]	235.449[a]
Del Rey	All	1947, 1948, 1949	C	2.797	10.328[a]
Ivanhoe	All	1947, 1948, 1949	C	403.325[a]	5.445[a]
Kingsburg	All	1947, 1948, 1949	C	544.661[a]	123.899[a]
Selma	All	1947, 1948, 1949	C	84.889[a]	14.256[a]

a/Significant at 99 per cent level of probability.
b/Significant at 95 per cent level of probability.
c/"t" test significant for Malagas, 1948-49, at 99 per cent level of probability.
d/Muscats, Thompsons, and Malagas.
e/"t" test on Muscats and Thompsons significant at 99 per cent level.
f/Clovis, Del Rey, Ivanhoe, Kingsburg, and Selma.

Table 12

Non-returns Tests of Significance of Differences among Means and Variances from Unbiased Trials, with Unequal Variances by Varieties, Years, and Years × Varieties

Source	Variety	Years	Years × Varieties		
Sumner	Dimmett	1917, 1918, 1919	B		
Rogers	Thompson	1917, 1918, 1919	B		
Scurry	Milaya	1918, 1919	C		
Tipple	Jackson	1917, 1918, 1919	B		
Dennis	Triune	1917, 1918, 1919	B		
Kimbley	Dimmett	1917, 1918, 1919	B		
Deaf Ley	Thompson	1917, 1918, 1919	B		
Randley	Milaya	1918, 1919	B		
Floyd	Dimmett	1917, 1918, 1919	B		
Crosby	Thompson	1917, 1918, 1919	B		
Garza	Milaya	1917, 1918, 1919	B		
Kimbley	Dimmett	1917, 1918, 1919	B		
Hutchinson	Thompson	1917, 1918, 1919	B		
Lubbock	Milaya	1917, 1918, 1919	B		
Cooper		1917	B		
Delano		1918	B		
Potter		1918	B		
Dallas		1917	B		
Ector		1918	B		
Ellis		1918	B		
Brooks		1917	B		
Medley		1918	B		
Floyd		1917	B		
Crosby		1918	B		
Garza		1918	B		
Kimbley		1917	B		
Hutchinson		1918	B		
Lubbock		1918	B		
Cooper	All	1917	C		
Delano	All	1918	C		
Potter	All	1917	C		
Dallas	All	1917, 1918, 1919	C		
Deaf Ley	All	1917, 1918, 1919	C		
Ellis	All	1917, 1918, 1919	C		
Hutchinson	All	1917, 1918, 1919	C		
Lubbock	All	1917, 1918, 1919	C		

* Significant at 99 per cent level of probability.
** Significant at 95 per cent level of probability.
" Just significant for 1917-18, 1918-19, at 99 per cent level of probability.
Crosby, Dimmett, and Garza.
" " Best on Dimmett and Thompson significant at 99 per cent level.
Floyd, Deaf Ley, Lubbock, Hutchinson, and Scurry.

APPENDIX TABLE VIII

Significance of Differences Among Means,
by Varieties and Areas of Origin, Winery B, 1947

	F
Reedley	
Within varieties--Alicante, Carignane, Muscat Zinfandel, Thompson	81.2
Within varieties--Alicante, Carignane, Thompson, Zinfandel	28.3
Within varieties--Thompson, Alicante, Carignane	19.5
Between Thompson and Alicante, Carignane, Zinfandel	1.040[a/]
Kingsburg	
Within varieties--Alicante, Muscat, Sultana, Thompson, Carignane	41.17
Between Thompson and Alicante, Muscat, Sultana Carignane	1.11[a/]
Parlier	
Between Thompson and Muscat	33.55
Sanger	
Within varieties--Alicante, Muscat, Sultana, Thompson, Zinfandel, Carignane	.08[a/]
Between Thompson and Alicante, Muscat, Sultana, Zinfandel, Carignane	1.88[a/]

a/ Not significant.

APPENDIX TABLE IX

Weekly Deliveries as Percentage of Seasonal Totals, by Varieties, Winery C, 1947-1949

Variety	Week ending									
	September 27	October 4	October 11	October 18	October 25	November 1	November 8	November 15	November 22	November 29
	IXa, 1947									
Alicante	7.0	7.0		3.4	41.4	24.1	10.3	3.4	3.4	
Black Monukka				100.0						
Carignane		9.5		21.4	50.0	14.3	4.8			
Cornichon					25.0	12.5	50.0	12.5		
Emperor			3.2	1.9	6.0	12.5	18.3	25.7	18.5	13.9
Feher Szago	11.4	14.3		22.9	8.6	17.1	20.0	5.7		
Fresno Beauty						25.0	75.0			
Golden Chasselas				50.0	50.0					
Grenache					27.3	54.5	18.2			
Malaga		.3	1.6	7.9	16.3	28.4	34.3	9.6	1.6	
Malvoisie	100.0									
Mission				100.0						
Mixed			20.0		20.0	40.0			20.0	
Muscat	.7	1.1	5.7	20.5	36.6	25.5	9.4	.7	.3	
Palomino	11.1		11.1	11.1	5.5	27.8	16.7	16.7		
Ribier				8.8	13.0	17.4	15.2	13.0	17.4	15.2
Sultana		.7	7.0	39.7	28.0	19.6	2.8	1.5	.7	
Thompson	1.4	8.1	18.2	17.5	31.4	13.1	.7	7.3	2.3	
Zinfandel					100.0					

(Continued on next page.)

APPENDIX TABLE IX

[illegible] Dollars as Percentages of Personal Income by Average Annual Rates, 1947-1960

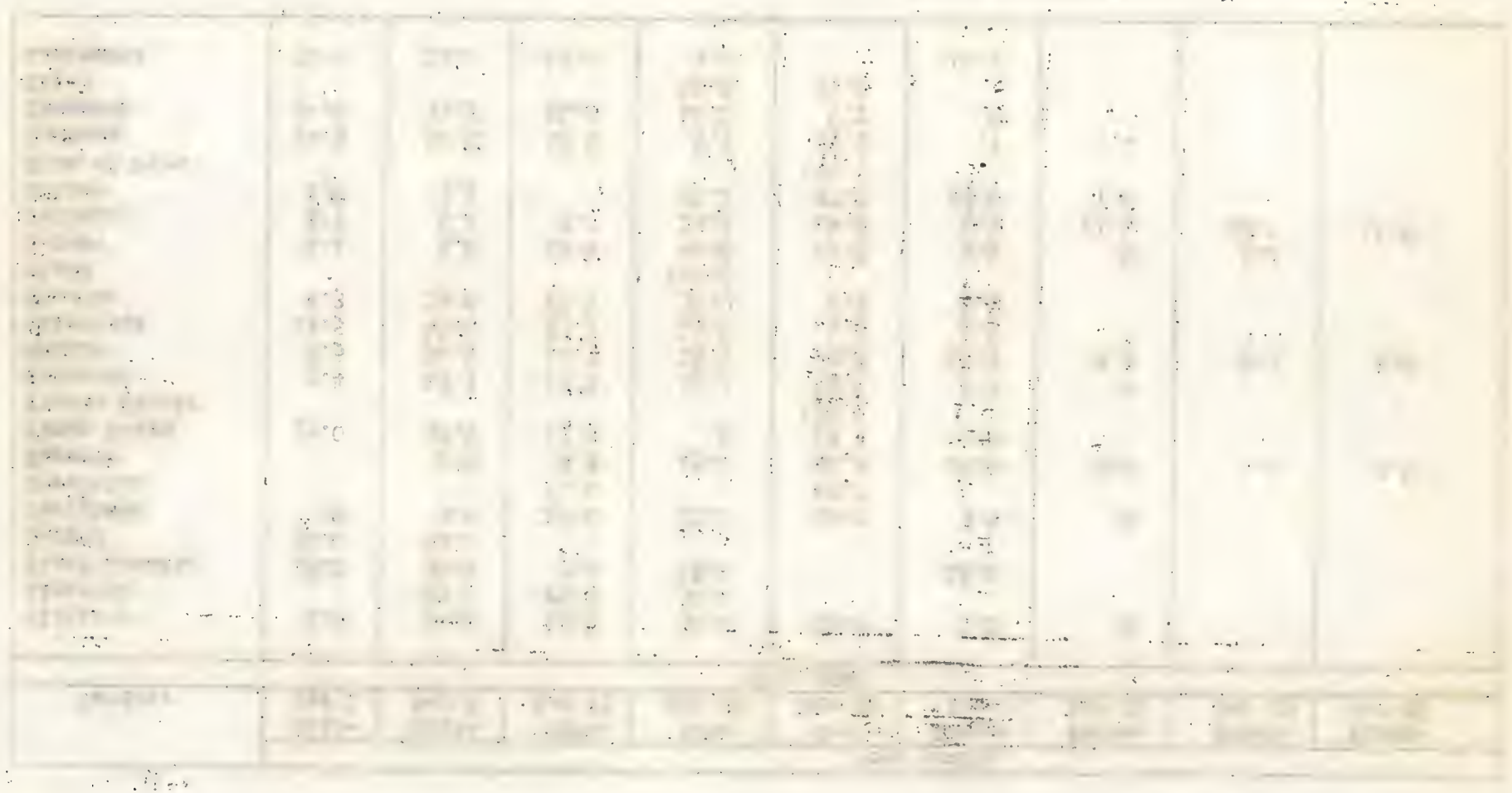
Table IX continued.

Variety	Week ending										
	September 18	September 25	October 2	October 9	October 16	October 23	October 30	November 6	November 13	November 20	November 27
	IXb, 1948										
Alicante				18.2	4.5	4.5	13.6	27.3	9.2	22.7	
Black Monukka				6.9			31.1	17.2	17.2	27.6	
Burger							100.0				
Carignane			1.4	8.4	9.4	8.4	4.2	22.1	27.2	16.1	2.8
Cornichon									50.0	50.0	
Emperor						6.9		13.8	34.5	41.4	3.4
Feher Szago		15.4	15.4	11.5		26.9	11.6	15.4		38.1	
Fresno Beauty							66.7			33.3	
Golden Chasselas								50.0	25.0	25.0	
Grenache			3.2	3.2	17.3	15.0	6.4	5.4	17.3	32.2	
Malaga		1.8	3.0	2.5	6.7	8.1	14.3	22.1	21.4	18.2	1.9
Malvoisie				33.3	47.7		9.5	9.5			
Mission				4.8	4.8		4.8	28.5	38.1	19.0	
Mixed							33.3	66.7			
Muscat			1.6	11.7	9.8	9.7	22.4	24.8	15.2	4.5	.3
No variety									100.0		
Palomino			4.3	23.9	34.8	6.5	4.3	10.9	15.3		
Ribier		2.3		9.1	13.6	9.1	9.1	6.8	25.0	11.4	13.6
Sultana	2.7	39.6	4.5	8.1	13.6	5.4	11.7	9.0	2.7	2.7	
Thompson	3.0	32.2	29.2	8.9	8.4	6.5	5.5	4.3	2.0		
Tokay							4.8	33.3	53.8	8.1	
Zinfandel				5.3	1.3		3.9	48.0	40.2	1.3	

(Continued on next page.)

Table IX continued.

Variety	Week ending								
	October 1	October 8	October 15	October 22	October 29	November 5	November 12	November 19	November 26
	IXc, 1949								
Alicante	1.9	10.8	19.8	30.6	28.8	7.2	.9		
Almerice		25.0	25.0	50.0					
Black Monukka	18.2	36.4	9.0	18.2		18.2			
Burger	50.0	50.0							
Carignane	.2	9.0	29.6	27.8	29.0	3.9	.5		
Cornichon			60.0		40.0				
Emperor		2.8	6.2	15.1	31.4	28.6	8.6	4.9	2.4
Feher Szago	34.0	36.8	13.2	.9	12.3	1.9			
Fresno Beauty					100.0				
Grenache	3.4	15.7	15.7	34.3	23.6	6.7	.6		
Malaga	2.5	10.2	10.5	14.5	40.2	14.5	2.9	2.1	2.6
Malvoisie	11.5	48.6	27.1	10.0	1.4	1.4			
Mission	4.3	19.6	26.1	37.0	6.5	6.5			
Mixed				100.0					
Muscat	1.1	4.8	24.4	40.6	21.8	5.4	.8	1.1	
Palomino	3.7	6.2	3.7	19.8	14.8	9.9	11.1	16.0	14.8
Ribier	1.6	3.1		31.2	37.5	18.8	7.8		
Rose of Peru					100.0				
Sultana	14.9	42.8	18.8	6.5	14.9	.7	1.4		
Thompson	34.6	33.5	16.2	10.2	4.7	.8			
Tokay				42.8	57.2				
Zinfandel	20.0	20.0	45.0	5.0		10.0			



APPENDIX TABLE X

Weekly Deliveries as Percentage of Seasonal Totals, by Areas of Origin, Winery B, 1947-1949

Town	Week ending August 14	Sep-tember 6	Sep-tember 13	Sep-tember 20	Sep-tember 27	Octo-ber 4	Octo-ber 11	Octo-ber 18	Octo-ber 25	Novem-ber 1	Novem-ber 8	Novem-ber 15
	Xa--1947											
Cutler				50.0		12.5					25.0	12.5
Delhi						100.0						
Denair							25.0		50.0	25.0		
Del Rey						33.3	17.6		17.6	25.5	5.9	
Dinuba	1.0		16.5	35.1	20.6	7.2	4.1		7.3	5.1	1.0	2.1
Exeter		6.9	17.2	20.7	10.3	31.0	3.5	6.9	3.5			
Fowler				3.8	7.5	47.5	31.2		3.8	3.8	2.4	
Fresno			16.0	25.2	31.8	14.0	4.7	.9	3.7	2.8	.9	
Hanford					50.0				25.0	25.0		
Ivanhoe					37.5				12.5	12.5	37.5	
Laton							100.0					
Kingsburg		.4	10.3	11.3	15.0	30.4	13.2	1.5	7.6	7.4	2.7	.2
Le Grande							100.0					
Lone Star											33.3	
Orange Cove				66.7								
Livingston		25.0	40.0	25.8	6.4		1.6		1.2			
Manteca					9.5	35.7	26.2		11.9	16.7		
Orosi			40.0		20.0	20.0		10.0				10.0
Stockton						100.0						
Parlier			1.2	4.4	6.7	15.6	20.0	1.2	7.7	17.7	23.3	2.2
Reedley		7.4	17.8	17.5	13.2	14.9	10.9	1.2	7.0	6.4	3.4	.3
Sanger		2.0	10.0	16.8	21.7	21.6	10.2	.8	4.2	7.2	4.9	.6
Selma			14.6	4.5	9.6	35.8	24.2		5.7	2.1	3.5	
Snelling			9.5	41.9	47.6	1.0						
Sultana										100.0		
Visalia						100.0						
Turlock			44.1			41.2	11.8		2.9			
Woodlake		18.7	31.8	19.6	15.0	6.5	3.7			4.7		
Per cent of total	.03	4.6	14.9	16.3	15.8	19.8	11.5	.9	5.8	6.3	3.6	.3

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Table X continued.

Town	Week ending											
	September 11 or before	September 18	September 25	October 2	October 9	October 16	October 23	October 30	November 6	November 13	November 20	November 27
	Xb--1948											
Clotho						33.3			33.3	33.3		
Kerman				100.0								
Lindsay			5.7			9.4	22.6	30.2	24.5	7.6		
Clovis	3.2	4.9	11.5	21.3	11.5	13.1	13.1	8.2	1.6	8.2	3.4	
Del Rey		.4	22.3	16.1	11.2	14.3	13.4	10.3	4.5	6.7	.4	.4
Dinuba	5.8	14.6	41.1	13.1	6.1	5.7	2.8	2.4	.8	6.5	.4	
Exeter	2.5	9.0	11.6	10.3	12.3	17.4	8.4	4.5	12.9	7.7	2.6	
Fowler		3.6	6.5	14.9	11.3	13.1	11.3	13.7	15.5	7.1	2.4	.6
Fresno		5.5	11.4	10.4	5.5	7.5	7.0	3.0	15.9	20.4	11.9	1.5
Hanford	2.2		8.9	22.2	28.9	26.7	4.4	6.7				
Kingsburg		3.2	13.1	7.5	22.5	13.1	11.9	2.5	13.1	11.2	1.9	
Livingston	1.8		26.1	33.3	11.5	18.2	7.3		.6	1.2		
Madera		8.6	42.6	10.6		2.1	2.1		4.2	14.9	12.8	2.1
Manteca						36.8		10.5	5.3	5.3	42.1	
Minturn								20.0	60.0	20.0		
Monmouth						30.8	15.4	53.8				
Navelencia		16.9	33.9	10.2	5.0	6.8	13.6	6.8	6.8			
Orange Cove			15.6	24.4	20.0	17.7	11.2	8.9				2.2
Orosi		.8	14.6	8.5	3.8	11.5	6.9	1.5	25.4	20.0	3.8	3.2
Parlier	.01	1.9	22.1	22.1	12.3	13.1	13.6	3.9	4.5	5.8	.7	
Reedley	.4	6.9	20.3	10.7	9.9	11.1	11.7	5.1	12.0	9.9	1.4	.5
Sanger	.8	6.7	19.2	14.1	11.1	10.5	12.4	10,2	8.7	4.8	1.3	
Selma	12.3	15.4	23.8	10.1	8.4	5.9	8.0	9.8	2.1	2.8	.8	
Snelling	1.7	12.3	14.0	17.3	3.9	8.4	15.1	19.0	8.3			
Sultana		5.9	35.3		29.4			11.8			17.6	
Per cent of total	2.1	6.7	19.7	13.6	10.0	11.2	10.4	7.5	8.9	7.3	2.2	.4

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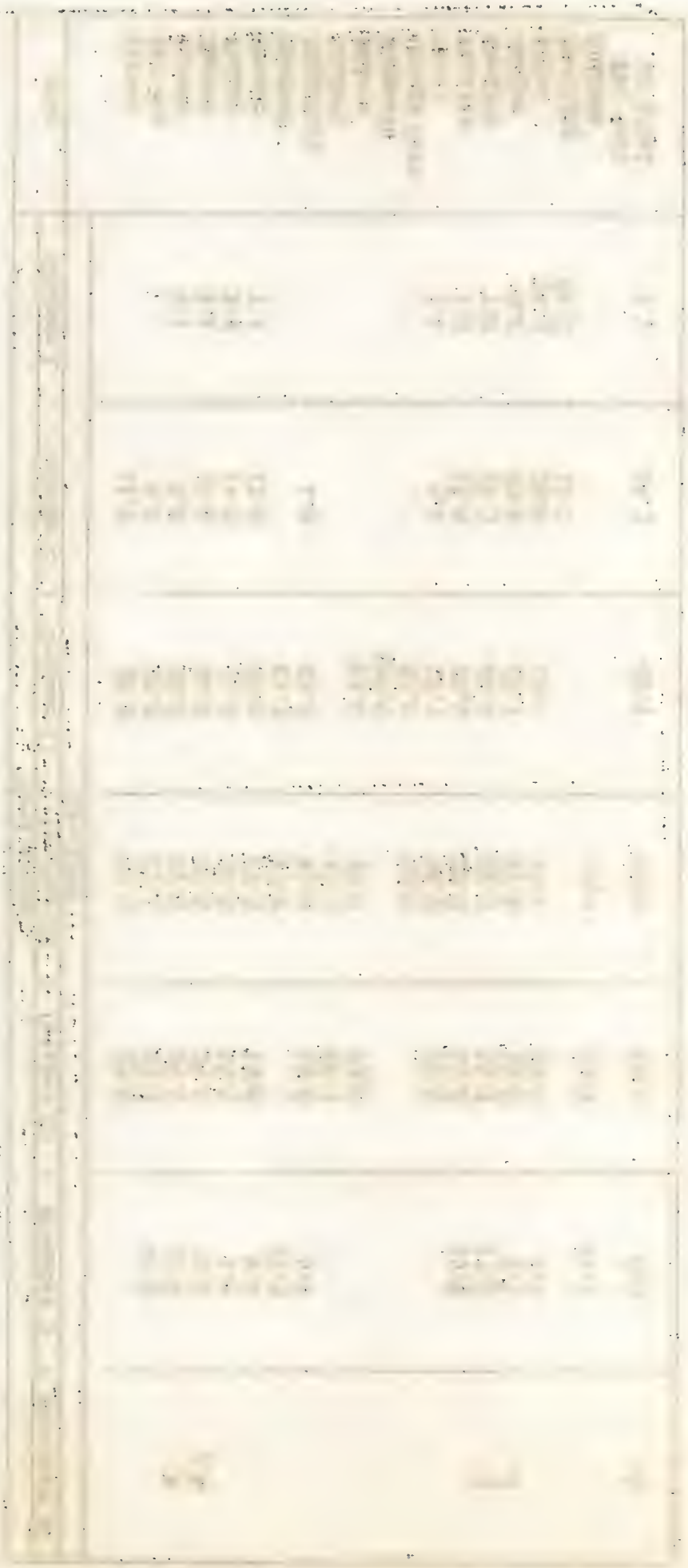
Table X continued.

Town	Week ending						
	October 1	October 8	October 15	October 22	October 29	November 5	November 12
	Xc--1949						
Clovis		11.9	32.2	20.3	35.6		
Del Rey		4.2	22.9	27.1	33.3	12.5	
Dinuba	4.1	4.6	28.6	27.8	24.1	10.4	.4
Exeter	4.1	14.9	21.2	16.6	24.6	15.2	3.4
Fowler	2.9	14.5	31.9	34.8	14.5	1.4	
Fresno	7.4	15.9	28.0	24.3	19.6	4.8	
Hanford			27.3	18.2		54.5	
Kingsburg		1.9	27.9	45.0	19.8	5.4	
Lindsay				33.3	66.7		
Madera			25.0	50.0	25.0		
Monmouth			100.0				
Orange Cove			80.0	20.0			
Orosi	9.4	3.1	18.7	46.9	21.9		
Parlier	1.8	15.8	28.0	22.8	15.8	15.8	
Reedley	7.2	18.3	22.6	22.3	15.7	13.6	.3
Sanger	6.2	20.2	26.7	27.4	13.8	5.4	.3
Selma	14.3	28.6	19.0	16.7	19.0	2.4	
Snelling	81.8	18.2					
Sultana				50.0	35.7	14.3	
Per cent of total	5.7	14.3	25.7	25.9	19.0	8.9	.5



APPENDIX TABLE XI

Weekly Deliveries as Percentage of Seasonal Totals,[a/]
by Areas of Origin, Winery D, 1949

Town	Week ending					Total loads
	October 1	October 8	October 15	October 22	October 29	
Armona	0	11.1	47.2	41.7		36
Biola	0	0	46.7	53.3		15
Clovis	0	7.7	11.5	80.8		26
Delano	28.4	28.4	21.6	20.3	1.3	74
Del Rey	0	17.8	51.1	31.1		45
Dinuba	0	25.0	0	75.0		4
Fowler	9.6	5.8	3.8	65.4	15.4	62
Fresno	19.0	28.6	32.3	19.8	.3	248
Hanford	25.0	12.5	6.3	56.2		16
Herndon	0	10.0	76.7	13.3		30
Kerman	25.0	75.0	0	0		4
Kingsburg	0	13.3	40.0	46.7		15
Livingston	0	18.2	45.4	36.4		11
Modesto	0	43.9	56.1	0		57
Parlier	0	0	0	100.0		4
Reedley	0	0	0		100.0	2
Sanger	0	0	0	0		138
Selma	54.1	37.2	6.5	2.2		46
Per cent of total	16.0	26.3	31.5	25.6	.6	

a/ Total weekly loads were, respectively, 133, 219, 263, 213, and 5, a total of 833.

APPENDIX TABLE XI

Weekly Deliveries as Percentage of Seasonal Totals,[a/]
by Areas of Origin, Winery D, 1949

Town	Week ending				Total loads
	October 1	October 8	October 15	October 22	October 29	
Arnona	0	11.1	47.2	41.7		36
Biola	0	0	46.7	53.3		15
Clovis	0	7.7	11.5	80.8		26
Delano	28.4	28.4	21.6	20.3	1.3	74
Del Rey	0	17.8	51.1	31.1		45
Dinuba	0	25.0	0	75.0		4
Fowler	9.6	5.8	3.8	65.4	15.4	52
Fresno	19.0	28.6	32.3	19.8	.3	318
Hanford	25.0	12.5	6.3	56.2		16
Hermdon	0	10.0	76.7	13.3		30
Herman	25.0	75.0	0	0		4
Kingsburg	0	13.3	40.0	46.7		15
Lavingston	0	18.2	45.4	36.4		11
Modesto	0	43.9	56.1	0		57
Parlier	0	0	0	100.0		4
Reedley	0	0	0		100.0	2
Sanger	0	0	0	0		138
Selma	51.1	37.2	6.5	5.2		46
Per cent of total	16.0	26.3	31.5	25.6	.6	

a/ Total weekly loads were, respectively, 133, 219, 263, 213, and 5, a total of 833.

APPENDIX TABLE XII

Estimated Number of Loads of Thompson Grapes Ineligible for Crushing Under Specified Minimum Sugar Requirements, by Areas of Origins, Winery C, 1947-1949

Area	Minimum percentage 1947					Minimum percentage 1948					Minimum percentage 1949				
	19	20	21	22	Loads	19	20	21	22	Loads	19	20	21	22	Loads
Fresno	3	14	41	61	105	1	5	25	93	434	0	0	4	5	148
Ivanhoe	0	0	1	1	3	0	1	3	14	30					
Del Rey	0	0	0	1	2										
Madera	0	0	1	1	2	0	0	2	20	67	0	0	0	1	37
Sanger	0	0	0	1	1	0	5	21	37	109	0	0	0	1	26
Selma	0	0	0	2	19	0	0	1	13	96					
Caruthers						0	0	4	11	14					
Clovis						0	0	0	1	31	0	0	0	1	27
Exeter						0	1	4	8	73					
Fowler						0	0	1	8	24					
Hanford						0	0	0	4	20					
Kerman						0	0	1	3	9					
Kingsburg						0	1	5	47	105					
Parlier						0	0	0	1	8					
Reedley						0	0	1	2	7					
All areas	3	14	43	67	132	1	13	68	262	1,027			4	8	238

APPENDIX TABLE XII

Estimated Number of Loads of Thompson Grapes Ineligible for Crushing Under Specified Minimum Sugar Requirements, by Areas of Origins, Winery 0, 1946-1949

Area	Minimum percentage 1947					Minimum percentage 1948					Minimum percentage 1949				
	19	20	21	22	Loads	19	20	21	22	Loads	19	20	21	22	Loads
Fresno	3	14	42	61	105	1	5	25	93	434	0	0	4	5	148
Ivanhoe	0	0	1	1	3	0	1	3	14	30					
Del Rey	0	0	0	1	2										
Madera	0	0	1	1	2	0	0	2	20	67	0	0	0	1	37
Sanger	0	0	0	1	1	0	2	21	37	109	0	0	0	1	26
Selma	0	0	0	2	12	0	0	1	13	36					
Sanger						0	0	4	22	14					
Clovis						0	0	0	1	31	0	0	0	1	27
Exeter						0	0	1	4	12					
Fowler						0	0	1	8	21					
Hanford						0	0	0	4	20					
Lemoore						0	0	0	1	3					
Kingsburg						0	1	2	17	105					
Parlier						0	0	0	1	8					
Reedley						0	0	1	2	7					
All areas	3	14	43	67	132	1	13	68	282	1,027			4	8	238